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Culturally Relevant Teaching: A Case Study on Teaching Statistics in the High School Setting

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CULTURALLY RELEVANT TEACHING: A CASE STUDY ON TEACHING STATISTICS IN THE HIGH SCHOOL SETTING

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DEDICATION

This work is dedicated to my greatest joys: my children, DeLacera and Trinity, for strengthening my life in so many ways. You two have made all the work and sacrifices worthwhile.

To my parents: Nathaniel Smith, for instilling a belief in working hard and persevering, and Mary E. Smith, for imparting in me a belief in God and for planting the seed to pursue my doctoral degree.

To my friends: Dr. Angela N. McLeod and Dr. Candace N. Porter, for their intellectual insight, editing suggestions, and always being of assistance when needed. This dissertation is also dedicated to my friend and new love, Andre, for believing in me and supporting me with unconditional love and encouraging words. You have been the "wind beneath my wings," especially during times when I was low. Thanks for providing the "workstation" to complete this project. I love and cherish each of you.

This dissertation is dedicated to all mathematics educators who are making a difference and striving to be positive, influential examples in the lives of their African American students.

Finally, this dissertation is also dedicated in memory of my sister, Patricia Ann Miller.

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ABSTRACT

Public school enrollment is increasing for African American, Hispanic, Asian/Pacific Islander, and American Indian/Alaskan Native students. However, minority and immigrant children tend to perform lower academically than White, middle-class students. Hence, there is a growing need to reform pedagogical practices for underachieving student populations to have improved chances for school success. Culturally relevant teaching is an effective approach to addressing the social and academic needs of minority students. The purpose of this study was to examine culturally relevant teaching in high school statistics classrooms of predominantly African American students.

Using a qualitative case study research design, this study examined two research questions: 1) What community referents (social, economic, religious, historical, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class? And 2) How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics class?

The study was conducted in three phases: Phase One consisted of identification of sites and recommendation of teacher participants. During Phase Two, demographic

information about the three teacher participants was collected and teacher interviews were conducted. Documents were reviewed and coded for the purpose of identifying themes and patterns for further data analysis. Phase Three used classroom observations to help contextualize the results. The researcher utilized the research literature to define culturally relevant teaching and to aid in framing this study and its contribution to the research literature on culturally relevant teaching practices.

This study provides evidence that culturally relevant teaching does exist at the secondary level in the statistics classroom. Observations and interviews of three successful high school statistics teachers of African American students revealed the ways that they perceive and enact elements of culturally relevant pedagogy. Culturally relevant characteristics of these teachers were demonstrated in four ways that replicated or extended previously published research literature. Teachers who practice culturally relevant teaching in high school-level statistics classrooms believe all students can learn, value the culture and language of their students and their families, and care about all students. These teachers also see their work as a calling and believe that they can make a difference in students' lives and communities. Finally, the data also pointed to a fifth element of culturally relevant pedagogy. A novel conclusion of this study is that high school-level students in classes that are taught by teachers who use culturally relevant teaching seem to care for each other; they collaborate with and actively encourage one another in the learning process. Caring teaching methods along with collaborative learning foster a positive learning environment in which students are able to move towards success in learning statistics.

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CHAPTER 1

INTRODUCTION

1.1 Introduction to Problem

> Teaching mathematics in classrooms, no matter what the level, engages students, teachers, administrators, and schools in contexts that vary from day to day in ways that make it difficult to create a formula, set of guidelines, or even a set of practices that all teachers should engage in (Franke, Kazemi & Battey, 2007, p. 226).

The type of pedagogy needed to help students think analytically, solve complex problems, and master complicated subject content is much more challenging than pedagogies needed to impart repetitive, low-level skills (National Council of Teachers of Mathematics [NCTM], 2000; National Governors Association [NGA] & Council of Chief State School Officers [CCSSO], 2010). Teachers are being asked to accomplish both simple and complex learning goals for *all* children, yet only very knowledgeable and adept teachers who are able to respond suitably to students' needs can assist diverse learners in successfully achieving the most difficult learning goals.

U.S. schools must become significantly more successful in supporting a wide range of learners if many more citizens are to attain the high-level skills needed to participate in a knowledge-based society (Darling-Hammond & Berry, 1999). Schools will continue to become learning settings where a homogeneous demographic of teachers (mostly White, female, middle class) will come into contact with a gradually more heterogeneous and distinguishable student population (primarily students of color).

Thus, teacher educators must now reconceptualize their methods of preparing new teachers in order to provide them with the skills and knowledge that will be best suited for effectively educating an increasingly diverse student population (Howard, 2003). Culturally relevant pedagogy is a way of teaching that improves the educational lives of African American and other minority students (Ladson-Billings, 2009).

Children in the United States are rapidly becoming more ethnically and culturally diversified (McIntyre, Rosebery & Gonzalez, 2001). Likewise, roughly 1.6 million South Carolina residents, nearly 35% of the state's population, belong to racial and ethnic minority groups. Each racial and ethnic minority group is internally diverse; that is, within each major group, there are subgroups with distinct languages, cultures, or backgrounds. South Carolina's population continues to increase and the majority of this growth is in racial/ethnic minority population groups. In the last decade, the number of people belonging to racial/ethnic minorities in the state has increased by over 18%. Over 81% of these minorities are African American, a total of 1.3 million South Carolinians (South Carolina Department of Health and Environmental Control [SCDHEC], 2008). African American students now represent the largest group of minorities in South Carolina schools (South Carolina State Department of Education [SCDOE], 2012).

Future teachers must understand that culture is learned. Therefore, it is crucial to investigate the nature of teaching and learning preferences associated with African American culture (Berry, 2003). The learning experiences that African American children are most commonly exposed to and may prefer are related to their cultural style. To capitalize on learning potential, teachers must form some continuity between African

American students' learning preferences and the existing culture of the schools they attend (Berry, 2003).

As part of the foundational knowledge in mathematics, there is a growing evolution to establish elements of statistics and probability in the secondary school curriculum (CCSS, 2010; Garfield & Ahlgren, 1988). Educators have reported that a large percentage of students do not understand many basic statistical concepts (Garfield & Ahlgren, 1988). In 2000, the National Council of Teachers of Mathematics (NCTM) produced a list of guidelines, *Principles and Standards for School Mathematics*, which set forth their recommendations for mathematics educators. Regarded as the primary model for standards-based mathematics, these recommendations form a national vision for preschool through 12th grade mathematics education in the U.S. and Canada. In the *Principles and Standards*, it is recommended that strong development of the data analysis and probability strand advances over the years. As a result, by the end of high school, students should have a sound knowledge of elementary statistics (NCTM, 2000). In addition, another element of the mathematics education reform agenda is a modification to incorporate a greater emphasis on statistics education. It calls for the incorporation of statistics concepts throughout the curriculum from pre-kindergarten through high school (Leong, 2006).

The Common Core State Standards (CCSS) Initiative is a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). The standards were developed in partnership with teachers, school administrators, and experts to provide an understandable and standardized framework to prepare children for college and the

workforce. These standards identify the knowledge and skills students should have within their K-12 education careers so that they will graduate high school capable of being successful in entry-level, credit-bearing academic college courses and in workforce training programs (CCSS, 2010).

Because "statistics and probability" is a Common Core domain (CCSS, 2010) and "data analysis and probability" is a content standard of NCTM's *Principles and Standards* (NCTM, 2000), it is important to make these content areas relevant and meaningful to students from different cultures, including African Americans. For the purpose of this study, the term **statistics** will be used to represent the "statistics and probability" element of the Common Core standards and the "data analysis and probability" strand of the *Standards*. Therefore, it is important that researchers focus on statistics and how underrepresented groups, such as African Americans, become successful in high school statistics class.

An increasing amount of research and development is being devoted to culturally relevant pedagogy (Kelly-Jackson, 2008; Moore, 2010; Tutak, Bondy, & Adams, 2011). However, there is little research specifically focused on statistics education and culturally relevant pedagogy. For this reason, there is an unfulfilled need to study the role that culturally relevant teaching plays in a statistics classroom.

1.2 Problem Statement

According to the U.S. Department of Education Institute of Education Science (IES), between fall 2008 and fall 2020, increases in public school enrollment are expected for African Americans, Hispanics, Asians/Pacific Islanders, and American Indians/Alaskan Natives, while a decrease in enrollment is expected for Whites.

However, disproportionately high numbers of minority and immigrant children perform generally lower academically than White, middle-class students (Gutstein, 2003). Hence, the need to reform pedagogical practices is essential if underachieving student populations are to have improved chances for school success (Howard, 2003).

Statistics is a subject different from mathematics, although essentially dependent on mathematics (Stuart, 1995). Shaughnessy (2007) reflected on the need to incorporate statistics into the mathematics curriculum:

> Prior to the *Standards*, statistics had been a lost stepchild in mathematics curriculum frameworks, the mere frosting on any mathematics program if there was time at the end of the school year. Now statistics is here to stay as a major strand in school mathematics programs in the United States (p. 957).

With the continued efforts to reform mathematics education for diverse students, including African Americans, it is important to study what teaching strategies are most effective. Successful teachers of African American students often integrate students' cultural strengths into their mathematics instruction (Rodriguez & Kitchen, 2005). Hence, culturally relevant teaching should be more strongly encouraged in the mathematics curriculum, including statistics classes.

A number of studies suggest that culturally relevant teaching is an effective approach to addressing the social and academic needs of students from diverse backgrounds (e.g., Kelly-Jackson, 2008; Ladson-Billings, 2009). Culturally relevant teaching is defined as making the learning process relevant to the student by incorporating the child's culture into the educational process. This pedagogical method emphasizes the need for learning material to be culturally specific (King et al., 1997). Kelly-Jackson (2008) asserted that culturally relevant teaching makes learning more relevant to and effective for students.

Although there has been some preliminary research on what culturally relevant teaching looks like in mathematics classrooms (Bonner, 2009), several important questions remain. Does culturally relevant teaching pedagogy affect the academic success of African American students in a high school statistics class? Does this type of teaching pedagogy make students more interested in statistics? Does this type of pedagogy make students think more positively about learning mathematics—and more specifically, statistics? And does this type of pedagogy make students feel that they have learned the objectives presented? The present study examined the interactions between students and with the teacher. This research explored the ways in which culturally relevant teaching pedagogy was utilized for African American students' learning of statistics.

1.3 Conceptual Framework

Culturally relevant teaching (Ladson-Billings, 2009, 1995; Gay, 2010) serves as the theoretical framework of this study. The following section describes this theoretical construct and how it informs the design and results of this study. This section also substantiates the reasoning behind the chosen approach.

Research in the areas of race and culture is broadening the understanding of how teachers shape academic success. Teachers' attitudes and expectations shape what they teach and how they teach it, influence the climate of their classrooms, and impact the achievements of their students (Graybill, 1997). Teachers' academic expectations influence student achievement levels while teachers' cultural backgrounds can also affect their perceptions of what is appropriate behavior (Graybill, 1997).

Teachers must move beyond the boundaries of their own cultures to educate themselves in the values and lifestyles of other racial and ethnic communities (Graybill,

1997). Ladson-Billings (2009) emphasized that educators must see racial and cultural differences as positive contributions to efforts to address the needs of African American students for the sake of the future. “While it is recognized that African Americans make up a distinct racial group, the acknowledgement that this racial group has a distinct culture is still not recognized” (Ladson-Billings, 2009, p. 10). Effective teachers make ongoing efforts to understand their students’ home and school lives at deep and contextualized levels, and they organize instruction in ways that enhance and build on what students already know (McIntyre, Rosebery & Gonzalez, 2001). Effective teachers of African American students “establish a welcoming ethos” and encourage students “to speak freely, learn collaboratively, and incorporate out-of-school experiences into the classroom” (Irvine, 1990, p. 90). To be most effective in their roles, teachers must create an environment and choose materials, displays, and texts that reflect African American culture. Most importantly, teachers should believe in the ability of all students to achieve (Graybill, 1997).

Culturally relevant teaching is a theoretical framework for education that embraces students from culturally diverse backgrounds (Ladson-Billings, 2009; Gay, 2010). It supports the connection between culture and learning and recognizes students' cultural capital in their academic success. Culturally relevant (responsive) instruction uses "the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them” and is “validating and affirming" to the students (Gay, 2010, p. 31). It is comprehensive, multidimensional, empowering, transformative, and emancipatory. Culturally relevant instruction teaches *to* and *through* the strengths of diverse students.

Ladson-Billings (1995) argued that culturally relevant teaching must have these three core tenets: "an ability to develop students academically, willingness to nurture and support cultural competence, and the development of a sociopolitical or critical consciousness" (p. 483).

Culturally relevant teaching demonstrates both a personal and instructional dimension (Gay, 2010; Ladson-Billings, 2009). In addition, culturally relevant teaching encourages students to be better citizens and more responsible and successful learners. It guides students in recognizing that there is more than mainstream ways of knowing and multiple methods of defining truth. "The validation, information, and pride it generates are both psychologically and intellectually liberating" (Gay, 2010, p. 37). In a sense, culturally relevant teaching teaches to the whole child (Caron, 2006).

Gay (2010) described culturally relevant teaching as possessing the following features:

- It acknowledges the legitimacy of the cultural heritages of diverse ethnic groups, and legitimizes cultural knowledge as a legacy that affect students' dispositions, attitudes, and approaches to learning as worthy content to be taught in the formal curriculum.
- It builds bridges of meaningfulness between home and school experiences, as well as between academic abstractions and lived sociocultural realities.
- It uses a wide variety of instructional strategies that are connected to different learning styles.

• It teaches students to know and praise their own and each other's cultural heritages.

• It incorporates multicultural information, resources, and materials in all the subjects and skills routinely taught in schools (pp. 31-32).

Teachers who practice culturally relevant teaching have high self-esteem and high expectations for their students. These teachers see themselves as artists and teaching as an art. They consider teaching as their way of giving back to the community and their students are encouraged to follow this sentiment. These teachers help their students make connections between their community, national, and global identities by guiding them in the learning process (Gutstein, Lipman, Hernandez, & de los Reyes, 1997; Ladson-Billings, 2009). In addition, teachers who support culturally relevant teaching practices believe that *all* students can succeed and achieve (Ladson-Billings, 2009).

Ladson-Billings (2009) further noted that if teachers treat students as if they were competent, students would ultimately demonstrate high competency. Teachers who practice culturally relevant teaching are passionate about their content and help students develop the necessary skills to understand the content knowledge. These teachers build a connectedness with all of their students; the relationship between student and teacher is fluid, humanely equitable, and extends beyond the classroom. The classroom is viewed as a "community of learners." Students teach each other and are co-responsible for their peers' learning. Knowledge is constantly recreated and recycled between student and teacher exchange.

Teachers who use culturally relevant pedagogy create relationships that allow them to maintain content-focused environments while also facilitating student

development and self-esteem (Ladson-Billings, 2009). In addition, student interactions are a vibrant social component within the classroom. Interactions with the teacher influence students' engagement and whether the students feel respected, supported, and motivated by the teacher (Corso, Bundick, Quaglia, & Haywood, 2013). Relationships with other students also impact student engagement. When students feel respected, supported, and accepted by their peers, or academically competent relative to other students, they are more likely to meaningfully participate in the classroom. This set of relationships—connecting with other students and with the teacher—contributes to a positive classroom learning environment (Corso et. al., 2013).

In addition to culturally relevant teaching, this study incorporates sociocultural learning, which is a way of learning where people generate knowledge in a social context (Wink, 1997). Within the classroom context, students who work collaboratively will take on specific roles to complete their projects and, critically, their language will be used to generate new thoughts and learning (Wink, 1997). "If students don't get to read and talk in a language they know, they don't get to learn; using our own language makes us smarter... Language develops cognition; words turn into thoughts, and thoughts turn into more words… All students need to talk and listen to each other in social, academic, and problem-solving context" (Wink, 1997, p. 88).

Using the conceptual frameworks described above, this study examined statistic teacher perceptions and enactments of culturally relevant teaching practices in high school classrooms that were predominantly African American.

1.4 Objectives

An objective of culturally relevant classrooms is to use the connections between culture, curriculum, home, and school to promote academic achievement (Baker & Digiovanni, 2005). There are three separate domains of human development: the cognitive, affective, and psychomotor domains (Lynch, Russell, Evans & Sutterer, 2009). The cognitive domain includes objectives that deal with the recall or recognition of knowledge; it also includes development of intellectual abilities and skills. The affective domain includes objectives that deal with emotions, such as changes in interests, attitudes, and values (Lynch et. al., 2009). Culturally relevant pedagogy has significance in both the cognitive and affective domains of learners. However, the present study focused on some aspects of the affective factors of culturally relevant pedagogy and will leave the study of cognitive factors for the future.

The goal of this research project was to study culturally relevant teaching practices for African American students who are being taught statistics. The research focused on how culturally relevant teaching is enacted in predominantly African American statistics classrooms. The objectives of this study are to 1) identify community referents that are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class and 2) explain how classroom interactions affect the implementation of culturally relevant teaching.

1.5 Research Questions/Hypotheses

The central assumption for this study is that using culturally relevant pedagogy will lead to improvements in student interest and attitudes. The following two research questions structured the study:

1) What community referents (social, economic, religious, historical, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class (Goldston & Nichols, 2009)?

2) How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics class?

Some of the hypotheses held about this research topic are as follows. If African American students are presented with culturally relevant teaching (if it can be demonstrated in a statistics classroom), the students may be more academically motivated. The students may also persist to study and be more productive. Second, if teachers use culturally relevant teaching, it may change the mindset of African American students and increase their sense of self-efficacy. In turn, they will succeed in statistics. Based on disciplinary training, prior knowledge, and/or experience, it can be deduced that if the teacher makes the subject more relevant, then the subject becomes more interesting. Third, if the subject is more interesting, the students may become more engaged. In turn, the researcher hopes that this chain of events will lead to academic success, which will be assessed in this study by students' levels of participation and amount and types of interactions in the classroom while learning statistics.

1.6 Definitions

Community referents are objects or events associated with a community or group of people within a community to which a term or a symbol refers. In this study, social, economic, religious, or political objects or representations of the community that teachers utilize to teach statistical principles were being explored. An example of a

community referent would be a local store or business or something that the students can identify with as being an important part of their community, such as a team or sport.

Culturally relevant (teaching) pedagogy is defined as pedagogy of opposition that builds on the thinking, experiences, and traditions of ethnically diverse students; for this study, the ethnically diverse students of interest are African American students. A pedagogy of opposition means that this type goes against the traditional way of teaching. This kind of pedagogy is committed to collective, not individual, sense of confidence (Ladson-Billings, 1995). Culturally relevant pedagogy is purposely committed to collective empowerment (Tate, 1995; Ladson-Billings, 1995) of students by using their culture and cultural referents to transmit knowledge and skills and to help students create meaning and understand the world (Ladson-Billings, 2009; Ladson-Billings & Henry, 1990). The term "culturally relevant teaching (pedagogy)" is associated with other terms such as culturally responsive, culturally sensitive, culturally centered, culturally reflective, and culturally contextualized teaching (Gay, 2010). Although the terms are slightly different, they contain some of the same core precepts.

Culture is defined as a dynamic system passed down from one generation to another. It is a system of behavioral standards, cognitive codes, social values, world views, and beliefs. Culture refers to the ways in which a group of people make meaning of their experiences through language, beliefs, and social practices (Delgado-Gaitan & Truba, 1991; Gutstein, Lipman, Hernandez, & de los Reyes, 1997; Irvine, 1990). In summary, culture is meaning that is shared by a group of people who hold common values and beliefs (Malloy & Malloy, 1998).

Multicultural education has been conceptualized as a reform movement designed to effect change in the "school and other educational institutions so that students from diverse racial, ethnic, and other social-class groups will experience educational equality" (Ladson-Billings & Tate, 1995, p. 61).

1.7 Significance of the Study

Previous research has revealed that African American students tend to perform worse academically than Caucasian students (Bonner & Adams, 2012; Howard, 2003; Malloy & Malloy, 1998; National Center for Education Statistics [NCES], 2013). The literature has also shown that African American students are not doing as well in mathematics in particular (Bonner, 2009). As a result, several researchers have been interested in investigating successful teaching practices of mathematics for African American students. For instance, Ladson-Billings (1997) noted that while the research literature conclusively documents the mathematics failure of African American students, there is insufficient evidence to substantiate the efficacy of specific mathematics teaching practices for African American students. Throughout her research, Ladson-Billings has found that improving the mathematical performance of African American students requires teaching practices that are meaningful to them, which include culturally relevant teaching. Culturally relevant teaching is a theoretical framework for education "that attempts to integrate the culture of different racial and ethnic groups into the overall academic program" (Baker & Digiovanni, 2005, paragraph 7). Furthermore, Ladson-Billings (1997) emphasized the need to make the most of African American students' education, not just for their own personal improvement, but also for a reformation of an inequitable, unjust society.

Along similar lines, Gutstein (2003) pointed out that students of color obtain unequal experiences, opportunities, and outcomes from their White counterparts. He also advocated for culturally relevant teaching to move toward greater equity and social justice. Furthermore, Kelly-Jackson (2008) recognized that multicultural education has different meanings to different people. She declared that culturally relevant teaching is a vital pedagogy under the grounds of multicultural education that promotes effective social and cultural equity for students of diverse social, ethnic, and racial backgrounds. Her research measures the importance of culturally relevant teaching in the classroom. To date, few studies have examined mathematics education as a distinctive tool for equity and social justice. The exploration of what it means to teach mathematics for social transformation is a new field of inquiry with much potential.

After assessing these studies and a few others (e.g., Chance, 2002; Irvine, 2010; Lajoie, 1999, Matthews, 2003), it can be concluded that gaps exist in the area of incorporating culturally relevant teaching in statistics classes. No study was found that examined the potential benefits for African American high school students who experience culturally relevant teaching in a statistics classroom. Prior research and theory suggest that culturally relevant teaching will develop sociopolitical or critical consciousness, willingness to nurture and support cultural competence, and academic success for students (Enyedy & Mukhopadhyay, 2007). This study will offer additional information about culturally relevant teaching in a high school statistics classroom setting (see Figure 1.1 below).

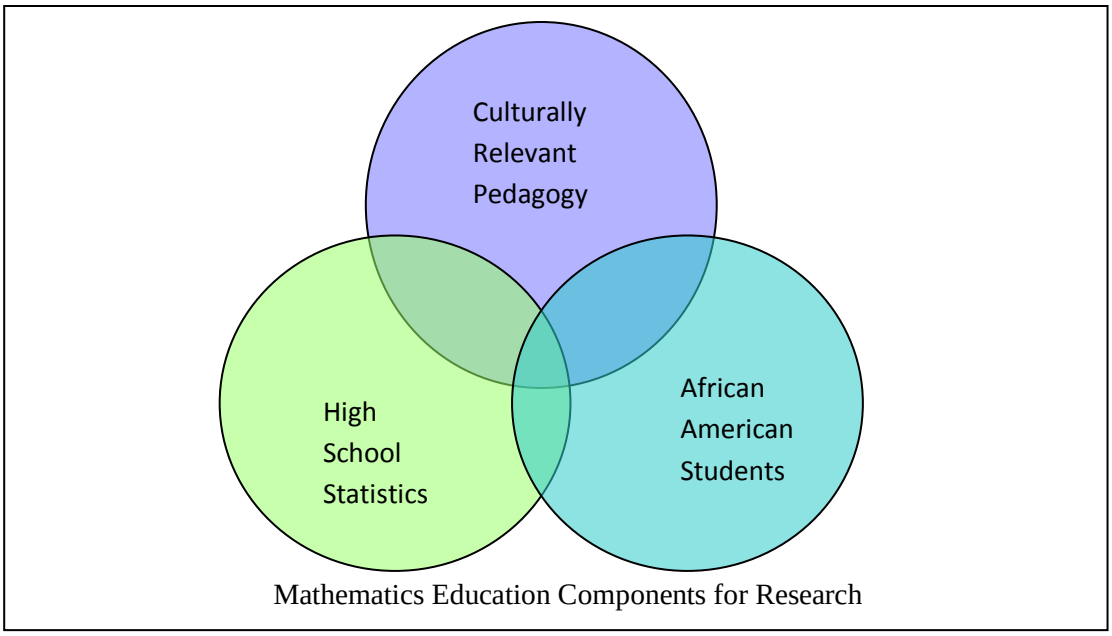

Figure 1.1 Diagram showing the relationship of components in this research project. Culturally relevant pedagogy is being studied. Within this pedagogy, the study is sampling African American students in the context of a high school statistics classroom.

Researchers have investigated what components make for a successful mathematics curriculum for African American students and how culturally relevant teaching can be effective for African American students in elementary mathematics classrooms. A majority of these studies (Goldston & Nichols, 2009; Irvine, 2010; Tate, 1995) discuss context in the elementary and middle school settings, but not at the high school level. Because mathematics and statistics are defined as different disciplines, it would be valuable to investigate if the benefits of culturally relevant pedagogy in a high school statistics classroom would emulate the benefits of culturally relevant pedagogy in elementary and middle school mathematics classrooms.

1.8 Delimitations

This qualitative study explored the effects of culturally relevant teaching practices for African American students in a high school statistics class. However, the research

design has a few inherent limitations. First, qualitative responses were collected from a sample of teachers (n=3). Additional research with students in diverse environments and from other types of mathematics classes will be needed to extend the generalizability of findings. Nevertheless, the present study can serve as an important precursor to the development of culturally relevant courses or culturally relevant *components* of multicultural education courses for pre-service and in-service mathematics educators.

The results of this study should not be generalized to other minority high school students because other races or ethnicities could possess different cultural dynamics. Other limitations could be addressed in future research using more thorough or quantitative methodologies that sample both teachers and students. In addition, longitudinal research designs would be beneficial in measuring possible long-term effects of culturally relevant teaching.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Organization and Rationale

This chapter will offer a review of the research literature on culturally relevant teaching practices and how they may apply to teaching high school statistics. The chapter will begin with the applicable literature that defines culturally relevant teaching and its relationship to mathematics teaching. Next, the researcher will present literature that describes the challenges of African American students in high school mathematics classrooms. Finally, a summary of research in the area of mathematics and statistics education will be given.

2.2 Culturally Relevant Teaching: Defining the Concept

"Culture is at the heart of all that we do in the name of education" (Gay, 2010, p. 8). In addition to that quote, Gay (2010) also expressed the importance of culture in the following statement: "Even without our being consciously aware of it, culture determines how we think, believe, and behave; and these, in turn, affect how we teach and learn" (p. 9). The research on culture and education has been taken a step further (Ladson-Billings, 1999; Gay, 2010; Howard, 1999) by developing culturally relevant/responsive pedagogy, a theoretical framework for education "that attempts to integrate the culture of different racial and ethnic groups into the overall academic program" (Baker & Digiovanni, 2005,

para. 7). Culturally relevant teaching uses student culture in order to preserve it and to transcend the negative effects of the dominant culture (Ladson-Billings, 2009).

Ladson-Billings has extensively described good teaching in her books and articles (e.g., Ladson-Billings, 1995; 1997; 2009), while also critically questioning why so little of these good teaching strategies are found in classrooms populated by African American students (Ladson-Billings, 1995). Her work has, in part, been built upon an idea adopted from sociolinguists: if students' home language is incorporated into the classroom, students are more likely to experience academic success (Ladson-Billings, 1995). Therefore, the concept of "cultural relevance" advances beyond language to include other facets of student and school culture (Ladson-Billings, 2009).

Culturally relevant pedagogy maintains that teachers need to be nonjudgmental and inclusive of the cultural backgrounds of their students in order to be effective facilitators of learning in the classroom (Brown-Jeffy & Cooper, 2011). When teachers look at African American students, they should know that "different does not imply nor translate as deficit" (Brown-Jeffy & Cooper, 2011, p. 68). Culturally relevant pedagogy focuses on the importance of culture in schooling; it does not focus on race and racism as they relate to the sociohistorical pattern of schooling in the U.S. (Brown-Jeffy & Cooper, 2011). "Thus culturally relevant pedagogy is a way for schools to acknowledge the home-community culture of the students, and through sensitivity to cultural nuances integrate these cultural experiences, values, and understandings into the teaching and learning environment" (Brown-Jeffy & Cooper, 2011, p. 67).

2.3 Culturally Relevant Pedagogy: Teaching and Mathematics

Research shows that teachers who use culturally relevant teaching pedagogies are usually teachers in elementary or middle schools (Irvine, 1990; Matthews, 2003; Tate, 1995). Most of the teachers sampled in the research were teachers at predominantly African American schools (Goldston & Nichols, 2009; Tate, 1995).

The focus for teachers ought to move away from what curriculum will be tested to how to engage both teachers and students in appropriate pedagogical practices for diverse populations (Baker & Digiovanni, 2005). Ladson-Billings (1995) pointed out that while teachers had state and local curriculum guidelines, it was the way in which they met and challenged those guidelines that defined them as culturally relevant teachers (Ladson-Billings, 1995). "Knowledge is continuously recreated, recycled, and shared by the teachers and the students. Thus they were not dependent on state curriculum frameworks or textbooks to decide what and how to teach" (Ladson-Billings, 1995, p. 163). Thus, the importance of multicultural education and culturally appropriate pedagogical practices becomes even clearer (Baker & Digiovanni, 2005). Students must be able to find a personal connection with education and the learning process to "buy into" education. Teachers should be flexible enough in curricula presentation to allow students opportunities to connect (Baker & Digiovanni, 2005).

Culturally relevant teaching for African Americans uses an Afrocentric approach to mathematics education. It rests on the assumption that Afrocentricity is not a fixed ideology but rather a dynamic strategy for understanding the thinking and experiences of African American students in school mathematics (Tate, 1995). Typical mathematical pedagogy emphasizes whole-class instruction, with teachers describing a technique to

solve a problem and students listening to the lecture. Students are then instructed to work alone on a set of textbook problems. The textbook problems are similar to problems from lecture and this pattern is repeated daily (Tate, 1995). Failing to provide African American students with mathematics curriculum, instruction, and assessment centered on their experiences, culture, and traditions is a major obstacle to achieving equity in mathematics education (Tate, 1994).

Too often, step-by-step methods of instruction are utilized in mathematics teaching, which worsen cultural incongruities that exist between teachers and students. Work in the area of culturally responsive teaching (Gay, 2010) provides a useful and powerful theoretical framework within which to explore these inequities while uncovering successful practices in classrooms that promote equity and access to mathematical knowledge. Within this framework, particular culturally-based pedagogies and effective styles of communication have been documented through the study of highly effective teachers of African American students (Gay, 2010; Irvine, 2010; Ladson-Billings, 2009). Using culture as the context to support mathematical understanding requires that teachers learn the culture of the student community. Specifically, teachers should be aware of the routine presence and functional applications of mathematics in the students' communities. Photographs of statues and other interesting artifacts from their neighborhood may be used to develop problems for students. This type of problem is culturally relevant because it empowers the students by giving them control of the task; challenges their intellectual, social, and emotional skills; and embeds mathematics in a cultural context that matters to them (Ladson-Billings, 2009). Students were highly

motivated by tasks involving brainstorming about mathematics seen in photos of children's neighborhoods (Leonard & Guha, 2002).

On the basis of the theoretical framework and findings thus far, the researcher presents a theoretical paradigm of mathematics instruction that is based on the CCSSM documents and their intersection with culturally relevant pedagogy in this particular context. The main components of this paradigm are the connections between the elements of effective mathematics teaching in a culturally relevant classroom and the *Standards for Mathematical Practice* of the CCSSM. The paradigm suggests that the *potential* relationship between the CCSSM and culturally relevant teaching involves thinking seriously about statistical knowledge and the community, the world, and building on students' informal knowledge and experiences. The researcher emphasizes the word *potential* because although a relationship between culturally relevant teaching and the CCSSM documents is possible, the two are not linked without thoughtful action.

There are five dynamics that Ladson-Billings (2009) highlights when she describes "Math in a Culturally Relevant Classroom." Those five elements are as follows:

> (1) The focus of the classroom must be instructional, (2) Effective teaching involves in-depth knowledge of both the students and the subject matter, (3) When teachers provide instructional "scaffolding," students can move from what they know to what they need to know, (4) When the students are treated as competent, they are likely to demonstrate competence, and (5) Real education is about extending students' thinking and abilities (p. 134-136).

These five elements foster learning in such a way that it lays the foundation for teachers to be able to incorporate the *Standards for Mathematical Practice*, which inspire students to develop the following skills:

> (1) Make sense of problems and persevere in solving them, (2) Reason abstractly and quantitatively, (3) Construct viable arguments and critique reasoning of others, (4) Model with mathematics, (5) Use appropriate tools strategically, (6) Attend to precision, (7) Look for and make use of structure, and (8) Look for and express regularity in repeated reasoning (CCSSM, 2010).

2.4 African American Students and Mathematics

Many researchers have examined African American students' performance in mathematics (Berry, 2003; Bonner, 2009; Ladson-Billings, 1997; Tate, 1995). Ladson-Billings (1997) powerfully stated that "Our [African American] students have immeasurable talents and innumerable strengths. That they do not do well in school in general and mathematics in particular does not add up" (p.707). She was highlighting the fact that African American students are intelligent and clever. However, the fact that they are not performing well in school, and especially mathematics, does not make sense.

Within schools, the primary routines and ways of teaching are often based in White culture, mirroring Eurocentric norms. The resulting practices are part of the cause of cultural incongruities in classrooms and schools, leading students of color to perform below their possibilities (Bonner, 2009). The compelling statistics on the life chances of African Americans, such as high rates of homicide, unemployment, incarceration (Pitre, Pitre, Ray, & Hilton-Pitre, 2009) and low achievement in mathematics content areas (Berry, 2003), suggest that whenever we can enrich the schooling experiences for African

American students, we have an opportunity to counteract their life chances (Ladson-Billings, 1997).

Although the disconnection between mathematics classroom practice from the experiences and traditions of African American students is not apparent, this disconnect symbolizes a loss of opportunity to learn mathematics (Tate, 1995). Research consistently shows that the traditional methodologies used to educate African American students in mathematics classrooms have failed them and are ineffective in promoting successful learning outcomes for African Americans (Pitre et al., 2009). Like other researchers, Pitre and colleagues state that "Part of the reason for the disparities may in part be due to poor teaching strategies and the cultural disconnect between mathematics and the African American students' home language" (Pitre et al., 2009, p. 66). Once more, the notion of a "disconnect" is mentioned here as researchers try to explain why African American students have not been successful in mathematics classrooms.

2.5 African American Students and Teaching

To maximize learning potential, teachers must create some association between the learning preferences of African American students and the culture of their schools (Berry, 2003). African American children have been shown to respond to those teachers who engage students through the use of culturally familiar communication patterns, high expectations, and firm and authoritative classroom management (Ross, Bondy, Gallingane, & Hambacher, 2008). "When teachers have high expectations, students respond to demanding behavior because they realize that the teacher believes that they can do more and can excel. In turn, students begin to believe it of themselves" (Bonner, 2009, p. 5). While identifying specific attributes that have been beneficial to African

American students has been helpful, it has been difficult to describe the whole practice of successful teachers of African American students in the context of mathematics (Bonner, 2009).

One of these beneficial teacher attributes that catalyze success in their students is having an immeasurable fund of knowledge. In mathematics, pedagogical content knowledge is crucial, yet knowledge of students' lives, cultures, and interests is also necessary. "It has been shown that successful teachers of African American students often use their cultural knowledge to refer to metaphors and family ties when presenting material, indicating a strong, almost familial, relationship with their students" (Bonner, 2009, p. 4; Ladson-Billings, 2009). In addition, a teacher's cultural knowledge allows her to effectively communicate ideas to students. She communicates to them her genuine care and that she has their best interest in mind. The caring attitude is complemented by a demanding and strict environment, an approach to instruction that is said to invoke positive responses from African American students (Bonner, 2009).

2.6 Mathematics and Statistics Education

Statistics is generally thought of as a section of mathematics. However, statistics became a separate field of study during the 20th century (Stigler, 1986, as cited in Bessant & McPherson, 2002). Furthermore, it has been said that statistics is not a branch of mathematics, but rather "an independent discipline" with its own unique origins, questions, and content (Moore, 1998, as cited in Bessant & McPherson, 2002). Another way of describing statistics is looking at it as a subject independent from, yet fundamentally dependent on, mathematics (Stuart, 1995). In the K – 12 level of education, statistics is a part of the mathematics curriculum. However, in the post-

secondary level of education, statistics is typically set apart from the mathematics program of study. For these reasons and because the debate of whether mathematics and statistics are one in the same, the researcher has organized this portion of the literature review primarily on statistics with some reference to mathematics teaching and learning.

2.7 Teaching Statistics

In their introduction of "Using Real Life Examples to Teach Abstract Statistical Concepts," Mvududu and Kanyongo (2011) said "statistics is not an easy subject to teach" (p. 12). They were expressing the fact that beginning statistics learners often encounter difficulties in understanding the topic. "Generally, the goal of statistics education is to answer real world questions. The student should develop sufficient competence to understand and draw accurate meaning from a statistical argument. Examples, therefore, should be presented in the context of real world problems" (Mvududu & Kanyongo, 2011, p. 12). From experiences in teaching statistics, some authors have found that it is helpful to relate statistical concepts to real-life situations (Mvududu & Kanyongo, 2011, p. 12). This suggestion opens the door to imply that using real-life situations along with culturally relevant pedagogy would be beneficial to students, including African Americans.

An illustration of using real-life situations in a statistics classroom is The Authentic Statistics Project (ASP). This approach is a prime example of how statistical understanding can be fostered in the classroom. Examples shared in an article by Lajoie (1999) were taken from an 8th grade classroom that implemented ASP. One premise of ASP is that if statistics is introduced in the K through 12 grades, students will be better prepared for decision-making in the real world. The goal of ASP is to provide students

with statistical knowledge and skills that can foster their independence in generating meaningful statistical investigations. ASP is generally introduced to students following a unit on graphing; the teacher builds on students' prior knowledge of graphing by relating it to data presentation. ASP anchors statistical concepts and the statistical investigation process through examples that model the use of concepts in a variety of real-world problems (Lajoie, 1999). In addition to using real-world examples, other ideas suggested to facilitate the learning of statistics include making the content more relevant to the students (Chance, 2002). This project is an example of how important researchers feel that problems with real-world relevancy (like those presented in the present study) are to the process of learning statistics.

The personal nature of understanding statistics involves the construction of knowledge by individuals through their own activities. In the production phase of ASP, design teams work together to plan, conduct, and present the results to the whole class (Lajoie, 1999). "How the students personalized their projects in terms of their own interests was reflected in their research questions" (Lajoie, 1999, p. 128). Additionally, communities of learning can be developed in classrooms by making conversation a normal classroom practice. Individuals need to share their understanding of statistics with others by communicating how they solve problems and reason with statistics (Lajoie, 1999).

A major concern of those who teach statistics is ensuring that the students understand statistical ideas and are able to apply what they have learned to real-world situations (Garfield, 1995). What happens in the classroom can be viewed as an interaction between the teacher's goals for what students should learn, views of students'

characteristics and attributes, theory of how students learn, and assumptions about how students should be taught (Garfield, 1995). Teachers cultivate statistical understanding by identifying prior knowledge that can be used to help students create relationships with statistical concepts (Lajoie, 1999). Lajoie (1999) summed up how to teach statistics best in her article when she stated the following:

> When learning new concepts, students constantly try to construct an understanding based on what they know. If students lack this knowledge, they actively seek information to fill in the gap. The teacher's job is to help students fill in the gaps with appropriate information (p. 115).

Statistics teaching can be more valuable if teachers decide what it is they really want students to know and to do as a result of their course, and then present activities designed to enhance the performance they desire. Appropriate assessment needs to be incorporated into the learning process so that teachers and students can determine whether the learning goals are being achieved—in time to do something about shortcomings before the course is over. Teachers need to consider the implications of research findings and determine how they relate to particular courses, students, and available resources (Garfield, 1995). Interactivity (human-to-human interactivity or human-to-computer interactivity), hands-on exercises, and well-documented real-life examples are features of a statistical course that can help inspire students' activity in class, ease understanding of statistical concepts, and make the whole course more interesting and enjoyable for the students (Mvududu & Kanyongo, 2011).

Even with good intentions, sometimes there are obstructions in teaching statistics. Statistics requires data collection and recording, and it is important to consider how data are collected and recorded to come to valid and reliable conclusions. If not done properly, measurements can present bias in surveys and experiments (Mvududu & Kanyongo,

2011). To achieve understanding, students need to engage in all phases of the investigative cycle of statistics, including data gathering, data analysis, and inference (Groth & Powell, 2004).

Groth and Powell (2004) describe two projects in which they attempted to help Advanced Placement (AP) statistics students become proficient at moving through the investigative cycle. Although these projects were implemented in an AP statistics class, they could also be included as part of any class in which linear equations and best-fit lines are studied. One project assigned during the first semester of the school year was focused on helping students master concepts related to correlation. The results revealed problems in students' reasoning. Students tried to make the intercepts of the regression have meaning even when they did not have meaning. Students also tried to force meaning on the intercept when it really had no useful physical interpretation. After identifying these gaps in students' understanding, teachers were able to address them in future instruction.

Helping students develop statistical thinking is extremely challenging. In addition to helping students master the mathematics needed for the analysis and inference phases of the investigative cycle, teachers need to help students master some of the non-mathematical elements of the cycle, such as identifying a problem, creating a plan of attack, and gathering necessary data. The teachers from the Groth and Powell (2004) article hoped that the projects and experiences that they described would add to the dialogue concerning how best to develop and foster statistical thinking.

Another project discussed in the Groth and Powell study allowed students to design their own statistical projects and posters. Teachers set aside approximately two

weeks to allow everyone in class to identify a quantifiable problem of interest, make a plan for investigating it, gather data, analyze the data, and draw conclusions (Groth & Powell, 2004). Students chose a number of different types of plans for completing the projects. Some students chose surveys; some chose to do observational studies. Others chose to use pre-existing data to help answer the questions they were investigating (Groth & Powell, 2004). Finding a truly random sample of students was impossible because some teachers would not let students out of class to assist with the projects. "The complicated and often imperfect nature of gathering data was conveyed to students in a manner that was far more memorable than conventional textbook instruction" (Groth & Powell, 2004, p. 108). This illustrates that even though real-life data gathering may be more meaningful, it may sometimes be a little complex. Again, this supports the idea of using relevant problem-solving techniques for students in statistics class as an effective means of teaching the subject.

In conclusion, the literature review in Chapter Two included excerpts of published research and literature on the topic of culturally relevant teaching and how it may apply to the teaching of high school statistics. The chapter started with applicable literature that defines culturally relevant teaching and its relationship to mathematics teaching. Next, the researcher presented literature that describes the challenges of African American students in high school mathematics classrooms. Finally, a summary of research in the area of mathematics and statistics education was given. The methodology chapter that follows will be used to outline how the present research study was conducted in reference to the literature presented in this chapter.

CHAPTER 3

METHODOLOGY

This study uses mathematics education as a context to connect the experiences of effective teachers of African American students and to examine how these teachers use culturally relevant elements to teach statistics. This study intersects disciplinary subjects as it encompasses mathematics and statistics education research to explore the connections of culturally relevant pedagogy and African American students. Common to work arising from culturally relevant pedagogy, this study will acknowledge the experiential knowledge of African American students within a mathematics classroom setting. The particular setting for this study, a high school-level statistics classroom, is a unique contribution to the existing literature concerning African American students and culturally relevant pedagogy. A majority of the studies discuss contexts in the elementary and middle school settings, but not at the high school level.

The purpose of this study was to study the practices of mathematics educators who employ culturally relevant teaching with African American students enrolled in a statistics class. The four objectives of this chapter are to (1) describe the methodology of this study, (2) explain the sample selection, (3) describe the procedure used in designing the instrument and collecting the data, and (4) provide an explanation of the procedures used to analyze the data.

This qualitative research study contains data collected from three high school mathematics teachers that were identified by their principals as skillfully incorporating

culturally relevant teaching practices. Qualitative research is an appropriate method to focus on gaining insight, discovery, and understanding from views of those being studied, and to make contributions to increasing the knowledge of practices that are improving African American students' academic efforts. The research design of this study used multiple methods of qualitative data collection to address the following research questions:

1. What community referents (social, economic, religious, historical, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class?

2. How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics class?

The data in qualitative research can provide a source of well-grounded, thorough descriptions and explanations of practices (Glesne, 2006) in the context of each high school mathematics teacher.

The mode of inquiry was case study. Case studies are conducted to obtain a better understanding of the culture and development of variable relationships in a single unit (Merriam, 2002). The case study research design allowed the researcher to gain a deep understanding of the life cycle or a significant part of the life cycle in its natural setting, attempting to understand the meaning of people and their world. A case study is also described as a thorough description and analysis of a phenomenon or social unit (Merriam, 2002). Each of the teachers' classrooms in this study was a social unit being examined as a whole. Examining each classroom as a whole allowed the researcher to

analyze the interactions between factors that explain the status of the unit and what influences growth. Merriam (2002) suggested that practice, policy, and future research can be directly influenced by case study research.

3.1 Sample

For this study, two regions of South Carolina were identified through the use of the South Carolina Department of Education (SCDOE) website: the Midlands and Santee-Lynches regions. This study was conducted in three phases. Phase One consisted of identifying schools and possible sites for research as well as securing approval and recommendations from district and school administrators on teacher participants. Phase Two consisted of making contact with teacher participants. Phase Three consisted of data collection and analysis. Phase One included selection of the Midlands and Santee-Lynches school regions because the areas were readily accessible to the researcher. The researcher used the South Carolina Department of Education (SCDOE) website to choose all the high schools in these regions by "grades served range" (9-12 SPED). All the schools that were non-traditional high schools (schools that did not offer core courses) were then deleted from the list. After those schools were removed, there were a total of 32 high schools in the targeted areas.

Next, the researcher obtained a list of schools with attendance by gender and race or ethnicity from the SCDOE website to determine which schools served predominantly African American students. Using this list, the researcher calculated the percentage of African American students at each high school in both regions. The researcher used purposive sampling to choose schools whose student populations are predominately African American in the Midlands and Santee-Lynches regions. Initially, the top 40% of

the total (40) high schools with the highest percentage of African American student attendance in the regions were chosen.

Next, a two-stage sampling process was used. The researcher began with a state sample of school districts stratified by location (using radial distance from the researcher's home and office). Within selected districts, a simple random sample was chosen. The sample was chosen in this manner because 1) a few of the schools with higher percentages of African American students did not offer a statistics course during the year/semester of research, and 2) many of the schools with higher percentages were denied access to the researcher.

Phase One of the study also consisted of sending an approval letter to the district superintendents (see Appendix A) to obtain preliminary permission to conduct research after the researcher determined which schools offered high school-level statistics classes. Once the superintendent or the research and assessment committee of the school district granted permission for research to take place at a chosen school in the district, the principal of the school was contacted. After the researcher received IRB approval, the principals were asked to identify teachers for participation in this study. The principals were asked to help identify ***mathematics teachers who teach statistics*** and possess the following characteristics:

- The teacher believes that all students can learn,
- The teacher values the culture and language of children and their families,
- The teacher cares about all children, and

- The teacher sees their work as a calling; that means they believe that together with the children and their families, they could make a difference in children's lives and their communities.

These four criteria are cited in Ladson-Billings' (2009) book as characteristics of teachers that practice culturally relevant methods. The researcher asked the principals to recommend teachers considered to be successful in the communities. The principals received an information letter (see Appendix B) by email asking him/her to use these criteria above to make teacher recommendations. Based on recommendation from the doctoral advisory committee, the researcher ultimately used convenience sampling and limited participation to three teachers for study feasibility and data management.

3.2 Measurement Instruments

In Phase Two, one of the instruments used to gather descriptive data was a Teacher Data Sheet, which was completed by the teacher participants. The researcher field-tested the Data Sheet and recorded feedback from the doctoral committee members. The researcher also used interviews of teacher participants as instruments to gain access into their inner experiences. The researcher chose interviewing as a means of data collection to illustrate the teachers' beliefs and experiences toward culture and pedagogy. In addition, interviews allowed participants to reflect on their teaching practices, knowledge, beliefs, and social relationships (Kelly-Jackson, 2008).

To bolster internal validity, the teacher interview was based on a thoroughly designed structure in an effort to obtain important information (Kelly-Jackson, 2008; Ladson-Billings, 2009; Sanders, 2001). The interview questions were adaptations of statements from Ladson-Billings book (2009) and dissertation elements from Kelly-

Jackson (2008) and Sanders (2001). The interview (see Appendix E) was semi-structured and lasted about 30 minutes. The teacher interview focused on the knowledge and awareness of teacher participants about culturally relevant pedagogy and how their experiences shaped their own teaching practices, what teaching practices best address their students' needs, and what challenges the teachers may face trying to implement culturally relevant pedagogy in a statistics classroom. The teacher interview and Data Sheet was informed by research from Kelly-Jackson (2008), Ladson-Billings (2009), and Sanders (2001). Some questions from each source were used. For example, Sanders (2001) had this statement in her survey: "Understanding the culture of students is important for improving academic performance." The statement was modified as a question for the teacher interview in this way: "Do you think that understanding the culture of student is important for improving students' academic performance in your statistics class? Explain." Another example was that Kelly-Jackson (2008) asked the following question: "What do you perceive to be the challenges of culturally relevant teaching?" The question was modified to: "What do you perceive to be the challenges of culturally relevant teaching in a statistics classroom?" Statements and questions were modified to focus on statistical education. To improve reliability, interview questions were constructed to align with what the researcher systematically assessed during observations in Phase Three. The following interview question was included to show how the teachers connect new knowledge of statistics to the students' home, community, or global settings while that same characteristic was observed in the observations: "How do you connect new knowledge of statistics to home, community, and global settings?"

In Phase Three, the primary instrument was classroom observations. Observations were used in Phase Three to help contextualize the study. Interviews and observations were utilized in conjunction to paint a complete and accurate picture of culturally relevant teaching in the high school statistics classroom. Observations were used to gather information and were analyzed for meaning and detecting patterns (Glesne, 2006). Data were sifted by repeatedly reading through interview transcripts, fieldnotes, and texts to reveal items pertinent to the research questions (LeCompte, 2000). Each classroom observation lasted 1.5 to 2 hours, based on individual school's class schedules.

3.3 Procedures

During Phase Two, the researcher made contact with teachers from the lists of principal-recommended teachers. Participation in the study was described as strictly voluntary. The teachers were told that they could choose to withdraw from the study at any time (see assent letter for teachers in Appendix C). When the teachers agreed to be in the study, then an informal interview (see Appendix D) and a Teacher Data Sheet (see Appendix E) was sent to elicit teachers' perceptions of teaching African American students and their ideas about culturally relevant teaching in the classroom and to collect demographic information, respectively. Each participant received a copy of the interview questions prior to the interview session. After each interview, the researcher used a Post Interview Reflection Form (see Appendix F; sourced from Jay, 2010b) to help interpret the data and make sense of the interview transcript (Kelley-Jackson, 2008). Interviews were recorded and then transcribed by a transcriptionist. The researcher sent the recordings to the transcriptionist to convert them to text data. Once the transcriptionist sent the text file to the researcher, the researcher sent each interview transcript to the

respective participant to review and make any necessary revisions. All three participants returned the transcripts with corrections or confirmation of their accuracy.

Observations focused on the participants' teaching practices, instruction, and learning environments to determine how those practices align with culturally relevant pedagogy. These elements were inspired by questions from the interviews that the researcher wanted to triangulate. These features proved to be observable and could be compared with what the teachers stated in their interviews. For example, in Mr. Davis' class, as students were working on a classwork assignment, a group of students were sharing answers. When one student did not get what other students got for an answer, another female student shared her computational steps and told the one who did not get the correct answer what steps she took and to divide by 19 to get the answer (Fieldnotes, 2/21/2014). This part was coded as culturally relevant learning environment—more specifically, as a "community of learning." Another example of an observation and how it was coded as ("value culture of student") teaching practice was when Ms. Smart was explaining an example of matching. She used an example of matching two male students in an observational study. The male students, she explained, would possibly be matched by number of parents in the home or by family income (Fieldnotes, 2/5/2014).

Before each observation, the researcher completed the pre-observation questions on the Observation Assessment and Reflection Form (see Appendix G; sourced from Jay, 2010a). Shortly after each observation, the post-observation questions were completed by the researcher. An example of using this form was from an observation of Ms. Newman's class on Wednesday, January 22, 2014. The researcher completed the form on that same day. For example, she answered questions three and five in the following manner. For

question three—*Identify the main information that you obtained (or failed to obtain) regarding the either a) the setting, b) the actors in the setting, or c) the action/activity in the setting [circle one]*—the researcher wrote, "Transfer of knowledge between students and the teacher. Trying to capture dialogue between teacher and students as learning taking place." For question five—*What were the main issues or themes that struck you as salient, interesting, illuminating, or important in your observation at this setting? Why?*—the researcher answered with "Reciprocal learning, students learning from teacher. Asking questions. Teacher learning new teen slang from students. The relationship that has/is being formed between teacher and students." The responses on the Observation Reflection and Assessment Forms described the interactions that the researcher saw on that day (Observation Form, 1/22/2014). The researcher coded this piece of data "Transfer of data," which fell under the major coding theme of "Social Interactions (between teacher and student)." The researcher had an observation session in Ms. Newman's class the next day. Because the researcher had answered the questions from the Observation Assessment and Reflection Form, it helped the researcher as she prepared for the next observation to focus more on taking good notes and thinking about how the actions in the observations would influence the findings of the study. This process, similar to the post-interview form, helped the researcher interpret what was viewed during the observation (Kelley-Jackson, 2008).

Data collection methods posed no risk to the students or teachers and utilized little instruction time. Although teachers were asked to reveal demographic information, their anonymity and privacy was protected. Although the participants may not benefit directly

from participating in this study, this study was designed with the hope that others will benefit.

3.4 Data Analysis

Qualitative researchers use many techniques to help organize, classify, and find themes in their data. One example of these techniques is coding. Whatever method is used, meaningful connections must be made both for the researcher and the reader. Data were analyzed throughout the research process, with the researcher defining patterns by methodically searching the data. Data analysis was performed in the following way: the data were first organized by individual schools, and then documents were reviewed and coded for the purpose of identifying themes.

By deploying a cross-case analytic framework (Merriam, 1998), cases can be compared by looking for patterns and themes in the data that are common across cases. This approach also allows for the investigation of discrepancies in notable outcomes or attributes and their contributing factors. In addition, this methodology allows for examining, identifying, and highlighting similarities and differences across cases that share a comparable profile within a related focus area. By analyzing both within and across cases, the identification of distinguishing features of the educators and their classrooms can be made.

The researcher worked systematically through the entire data set, giving full and equal attention to each data element, and identifying noteworthy aspects in the data items that may have formed the basis of repeated patterns or themes across the data set. The researcher initially identified ten codes and then matched them up with data extracts that revealed that code (Braun & Clarke, 2006). Teachers' responses from the interviews and

data sheets were compiled and reviewed to identify dominant themes; coded fieldnotes were matched to themes in the open-ended responses. For example, one of the Teacher Demographic Information Questions was the following: *12. What kinds of things have you done in your statistics classroom that has facilitated the academic success of African American students?* The answer that Ms. Newman gave was: "Get to know them first!! Hear them and [learn] about the things that are important to them. Relate stats to their lives; use their lives' data as examples." This response was matched and coded as "Teacher cares about all students" to data in reference to fieldnotes on the Student Survey that students used to complete projects (Fieldnotes, 2/7/2014). This response was coded as a caring component because the teacher used their Senior Survey data to relate statistics to students' lives. Compiling and categorizing responses while generating themes and patterns is an effort to explain the data (Braun & Clarke, 2006). Fieldnotes were organized around categories in the interview.

For the analysis of this study, the researcher used information from the literature review and the research questions to create codes. The researcher used theoretical thematic analysis, which is a process of coding the data by trying to fit information into a pre-existing coding frame, the researcher's analytic preconceptions (Braun & Clarke, 2006). From the literature review, the research pointed to four main themes in this study: the teacher believes all students can learn, the teacher values the culture and language of children and their families, the teacher cares about all children, and the teacher sees their work as a calling.

Observation notes were reviewed, analyzed, and coded; these notes, along with the demographic data, served as a tool to triangulate the interview data (Merriam, 2002).

An example occurred in Ms. Smart's class that will illustrate this point. Ms. Smart was talking quietly to a student about her attendance. She said, "I'll bet you two nickels!" Ms. Smart was trying to let her student know that she cared about her and her attendance/absences (Fieldnotes, 02/16/2014). The researcher used the theme "Caring Relationship with Students" for that student-teacher interaction. On the Observation Assessment and Reflection Form, the researcher noted that the main issues or themes that struck as salient in the observation at that setting (Fieldnotes, 2/16/2014) was that Ms. Smart really cares for her students and their personal and academic lives. In her interview, Ms. Smart was asked: *Do you engage in dialogue with students about values, the importance of learning, and the consequences of not getting quality education? Why or why not?* After class that day, Ms. Smart was having a conversation with this same young lady and asking again about her absences. The student told Ms. Smart that she was pregnant. Ms. Smart pulled her close and hugged her. She began to talk to her about teenage pregnancy as the researcher walked out of the classroom (Fieldnotes, 02/16/2014). This interaction, too, demonstrated her caring relationship with her student.

Triangulation was frequently employed to verify findings, using multiple sources of evidence for the purpose of furthering verification into all the data collection methods (see Table 3.1). This process required listening and re-listening to interview recordings, cross-checking documents and fieldnotes to match codes, categories and themes. In this study, the use of different sources to collect data (interviews, observations, and data sheets) provided a means to obtain information about teachers' beliefs and practices. Another means of seeking triangulation was a constant reference to Chapter Two's review of the literature. Referring to the literature review was another way to examine the

transcripts from the interviews, the data, and the fieldnotes. The interviews were recorded, transcribed, and reviewed by the teacher participants to ensure accuracy.

Culturally relevant teaching requires teachers to possess a thorough knowledge of the content and employ multiple representations of that knowledge and use students' lived experiences to connect new knowledge to home, community, and global settings (Irvine, 2010). In this particular study, the researcher used questionnaires, interviews, and observations to study culturally relevant teaching practices in high school-level statistics classrooms. The researcher looked for reference to relevant community symbols used to teach statistics. The researcher paid close attention to the relationships between teacher and students and the interactions of students among each other.

Table 3.1 *Research Questions and How Methods Were Used*

Research Questions	**Data Collection Methods**	**How Will Data Collection Methods Be Used/Influence the Results**
What community referents (social, economic, religious, historical, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class?	Observations in classrooms, Teacher Interview Questions, Researcher Fieldnotes	✓ Use data collection methods to answer research question ✓ Use data collection methods to inform researcher about culturally relevant teaching, specifically in the high school-level statistics class

How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics classroom?	Observations, Videotape of lessons, Researcher Fieldnotes	✓ Use the data collection methods to describe inter-actions between teachers and students, and also among students ✓ Describe the interactions and what they look like in a statistics classroom ✓ Explain how the interactions foster culturally relevant teaching in a high school-level statistics classroom

The researcher used questionnaires, fieldnotes, observations and data from teacher interviews to comprehensively describe the culturally relevant teaching practices of the high school-level statistics classroom.

Research on culturally relevant pedagogy and culturally relevant educators both acknowledge the role of teachers' knowledge, beliefs, and practices in understanding and improving instructional practices in the culturally diverse classroom. Exploring patterns that emerge from educators' practices across different culturally relevant classrooms adds to the credibility of this study. For this reason, case study analysis was utilized in this study.

Member checking was utilized in this study as a means of building credibility. Member checking included sharing interview transcripts and/or drafts of the final report with research participants to ensure accurate representation of the ideas (Glesne, 2006). Member checks occurred as the researcher intentionally allowed teachers to offer their

feedback and insight throughout the process. The full written report of this study will be made available to the teacher participants for the purpose of learning how their contribution, as well as the contributions of other participants in the study, assisted in this project. The process was consistent by using the same methods of data collection for each teacher participant. Due to time limitations in observing teachers from different areas of the state, rapport was established and developed in a short period of time. The camaraderie that was built between the researcher and teacher participants continued throughout the gathering and analyzing of the data.

This study sought to describe beliefs and practices of educators who use culturally relevant pedagogy in their high school-level statistics classrooms and to clarify what these educators believe to be important in implementing culturally relevant practices. In addition, this study explored how caring relationships may have shaped and impacted their teaching practices.

CHAPTER 4

RESULTS

This study was conducted to investigate culturally relevant teaching practices for African American students in high school statistics classrooms. Teachers were selected based on recommendations from principals or mathematics department chairpersons. The teacher participants were asked to answer 12 questions in a demographic questionnaire and 20 questions in a recorded one-on-one interview. The interviews along with researcher observation of the teacher participants in their classrooms illuminated the beliefs and practices of three mathematics teachers who were suggested because they skillfully used culturally relevant pedagogy in their high school-level statistics classrooms. The teachers' behavior in the classroom and responses to questions clarified what these educators believe to be important in implementing culturally relevant practices.

To review, the research questions for this study were:

(1) What community referents (social, economic, religious, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class?

(2) How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics class?

In this chapter, the results of the Teacher Demographic Questionnaire, teacher interviews, and observation data will be reported. This chapter is organized in the following manner:

first, the teacher participants and the settings where the observations took place are described. The descriptions of the teachers' clothing are important to show that the teachers care about the way they dress; this attention to attire suggests that the teacher participants care about who they work with and about their profession (Ladson-Billings, 2009). Classroom descriptions are important to show culturally-influenced décor and to present a picture of how students are seated. The sketch of the seating helps to show how readily students are able to work collaboratively in the classroom. Next, the researcher discusses community referents that are perceived by the teacher participants as important in conceptualizing culturally relevant practices. Finally, the researcher evaluates how classroom interactions affect implementation of culturally relevant practices in high school-level statistics classes.

Current trends in secondary mathematics education support that teachers provide pedagogy that builds and expands on the thinking and experiences of African American students. Some teachers see themselves as professionals and also personally identify with the teaching role. During this study, the researcher had the opportunity to work with teachers who use culturally relevant approaches that, in spite of their differences, had one goal: to see their students succeed. Table 4.1 offers demographic information to describe the three participants' ethnicity, ages, education, career, and background.

Table 4.1 Teacher Demographic Data

Participant	Ms. Newman	Mr. Davis	Ms. Smart
Ethnicity	East Indian	Caucasian	African American
Age	Over 40	22-26	Over 40
Highest Degree Earned	Master's Degree	Bachelor's Degree	Master's plus 30
Number of Years Taught	11 – 15 years	0 – 3 years	More than 20 years

Type of High School Attended	Public	Public	Public
Type of College Attended	Large, Research I public university	Large, Research I public university	Historically Black liberal arts college for undergraduate degree; Large Research I public university for graduate degree
Type of Community Raised In	Small town	Small town with one public high school	Predominantly African American community in a southern city

4.1 Introducing Ms. Newman

> I use who they are. I use their lives in my room and I hope that maybe I can put a little perspective on their world and their lives. Maybe I can show in a different way by conversation or by math problems, by stats. - Ms. Newman

Ms. Newman is a self-identified East Indian, 40-plus-year-old mathematics teacher at Brisbon High School. The student population at this school is 48% African American, 48% Caucasian, 2.9% Hispanic, and 2.0% Other. Ms. Newman usually dresses in cargo-type pants/capris that are gray or khaki-colored, a casual top, and tennis shoes or boots. She has a Master's Degree in Education and received her Bachelor of Arts in Secondary Education, Mathematics from a large Research I public university. Ms. Newman has taught for 11 to 15 years total, and 8 to 10 years have been taught at her present school. Ms. Newman was recommended to participate in this study because she is regarded as an effective teacher of African American students. Her principal said that her personal relationships with her students and her dedication to create engaging and meaningful lessons make her successful. Ms. Newman attended a public high school in South Carolina. She describes the type of community she was raised in as a "small town." Ms. Newman works with her colleagues, attends workshops, and uses the Internet to gain new

ideas and insight into teaching statistics. In order to facilitate the academic success of African American students, Ms. Newman takes time to get to know her students first. She hears them and learns about the things that are important to them. She relates statistics to their lives and uses data from their daily lives as examples when possible as she teaches statistics.

On the first day of class, Ms. Newman spent substantial time hearing the stories of her students—whatever the students wanted to share. They may share that information through a questionnaire, a poem or life map, or some other "get to know" activity. Her intention is to "hear them," to hear what their hobbies or interests are, where they have been, and what their ambitions are. She uses that information in class by pulling up an article on salaries of basketball players they may talk about or on issues that are important to her students. She has two students, both seniors, who are young mothers. They had a discussion and looked up some statistics about young and single parents and how many make it to college. Ms. Newman hoped that the activity would give the young women the idea that it is possible to continue their education, even with a child.

Ms. Newman's high school classroom is filled with students who have warm and welcoming faces. The students at the school and in her classroom appear to be very mild-mannered. On the first day of observations, Ms. Newman introduced me to her students. On the third day of observations, the students went outside to do an activity. The researcher refers to the students as "warm and welcoming" because when all the students were finished with the activity, they invited me to participate also. The activity was one in which they collected numerical data of length. The students were blindfolded and asked to walk in a straight line. At the beginning of the activity, two tape measures were

laid out in a straight line beside each other. Once the student started veering to the right or to the left of the outer perimeter of the tape measures, then his or her partner was asked to note the spot and look on the tape measure to see how far they had walked in a straight line. The data were created by the students; therefore, it was relevant to them. They were excited to see who could walk the farthest and tried to figure out why the person could do it so long (Fieldnotes, 1/23/2014).

When the researcher first started doing observations in Ms. Newman's classroom, there were 20 students (9 females and 11 males). During the research, the numbers fluctuated; by the last observation session, there were only 15 students (7 females and 8 males). When the researcher first started the observations, it was the start of the new semester, when students typically make schedule changes. Often, all classes get changed around to accommodate a change to one class. The ethnicity breakdown of the students in the class was as follows:

Beginning

- 14 African American
- 5 Caucasian
- 1 Asian American

End

- 11 African American
- 3 Caucasian
- 1 Asian American

The room has desks in rows, facing towards the front of the classroom and the door (see Figure 4.1). The teacher's desk is in the left corner of the room, facing the students' desks. There are file cabinets and another cabinet in the corner behind the teacher's desk. Two bulletin boards are on either side of the interactive white board at the front of the classroom. There are two dry eraser boards on the left wall in the classroom. There is a big, round clock above the interactive white board in the front of the room.

Posters are on the front and right side wall; the posters are of rules, Mathematical Quilts, the quadratic formula, line equations, exponents, Math of India, Math of Egypt, volume formulas, and geometry formulas. There are also two Albert Einstein posters in the classroom.

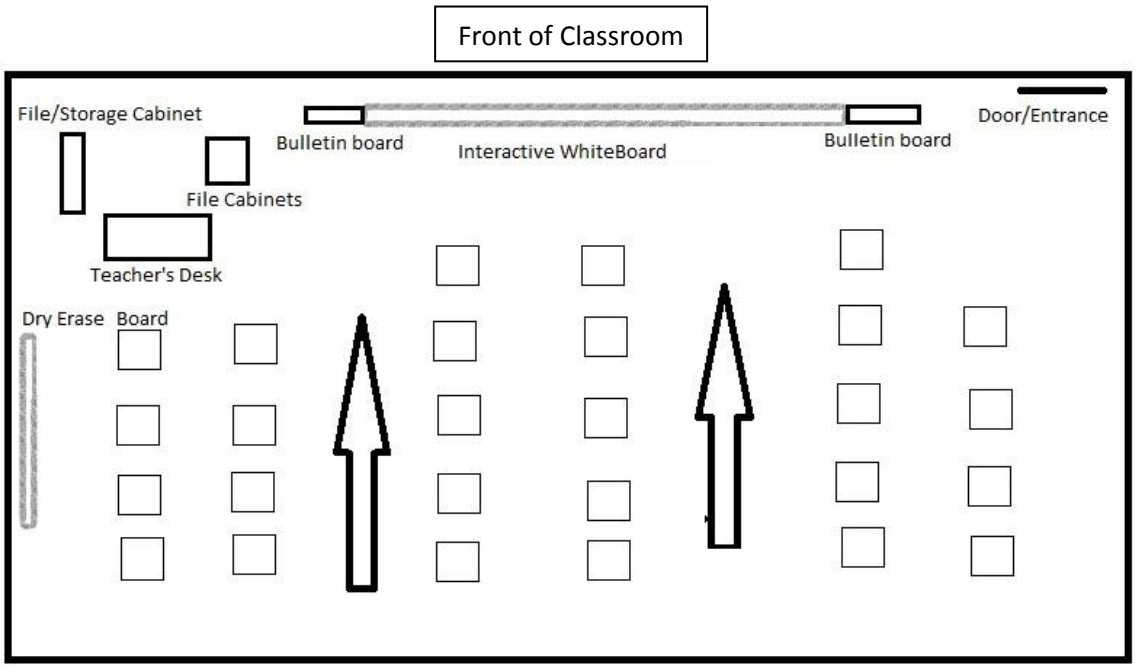

Figure 4.1 Diagram of Ms. Newman's Classroom

4.2 Introducing Mr. Davis

> I do believe that all students can succeed and achieve, but I don't think we can measure success the same way for each student. I have a tough time believing that every child that comes in my classroom can end up at the same point upon leaving, but I do not think it's unreasonable to think that every child that comes into my classroom can get better while they are in here. - Mr. Davis

Mr. Davis is a White male, aged 22 to 26. On any given day, he wears brown/khaki-colored dress pants, a dress shirt with a tie, a black sports jacket, and blue/white/silver/black tennis shoes. He has a Bachelor of Science in Mathematics Teaching degree from a large Research I university (he and Ms. Newman attended the

same college) and is currently working on his Masters of Education in Educational Administration. He has been teaching for almost two years at Carolina High School, the same high school where he began his teaching career. Carolina High School's student population contains 43% African American, 51% Caucasian, and 4% Other. Mr. Davis was recommended to participate in this study because he is regarded as an effective teacher of African American students. His principal said that he is very content-knowledgeable and builds good relationships with his students. Those are the specific characteristics that his principal mentioned as he gave reasons for why Mr. Davis is a successful mathematics teacher of African American students. He also attended a public high school and college in South Carolina. He presently teaches 11th and 12th grade students. He was raised in a small town, where there was one public high school and one small private school for K-12. He described the local economy as "very sluggish." He also said that the unemployment rate seemed to be very high, and that the largest employers were the school district and local hospital in his community. Mr. Davis is teaching his second semester of statistics. He said that he has not "made it too far out of the box as far as searching for new ideas and insights." He has tried to match the rigor and expectations of the Common Core State Standards "by including many text-based questions and making writing a requirement on nearly all" of his assessments. He allows his students to work with one another on a daily basis, tries to use examples that are relevant to his students, and places a lot of emphasis on the use of technology, specifically the TI-83 calculator, to facilitate the academic success of his African American students.

An example of Mr. Davis using data relevant to his students was shown on February 6, 2014. He used the Student Height Data Set. The students were given an assignment using a data set with the heights of male and female students, data that the students had collected the day before. He told his students to use the calculators to maximize efficiency and to calculate the mean, variance, and standard deviation (Fieldnotes, 2/06/2014). For this assignment, he also asked the students to find the range, sample size, median, and mode for each data set. Finally, Mr. Davis also asked the students to make a frequency distribution chart for the male and female height data sets.

Mr. Davis' class is almost filled to maximum capacity. He has 29 students (8 females, 21 males) and 32 desks (see Figure 4.2). His desks are in two groups of rows that face each other. His teacher's desk is in the far corner at the front of the room directly in front of the door/entrance of the classroom. There is one long window behind the teacher's desk and one along the same wall at the back of the classroom. There is a television mounted above the teacher's desk. There is an interactive white board at the front of the classroom and a dry erase board at the back of the classroom. The demographics of the classroom students are as follows:

- 21 African American students
- 8 Caucasian students

4.3 Introducing Ms. Smart

> I don't know if it is more so my culture than my belief system. I believe everybody is equal; everybody has the same rights and privileges as everybody else. Everybody should be treated as such. So I try to treat, and I do… I treat all of my students the same: firm, but fair. So they all feel that they are on the same level playing field. So I think knowing that, for me, that I am able to reach some that may not have been able to have been reached maybe in different circumstances. Because I am not going to judge them for anything they have done. It could have

happened yesterday. If it happened yesterday, it's water under the bridge. Yesterday is dead and gone. Today is a new day. - Ms. Smart

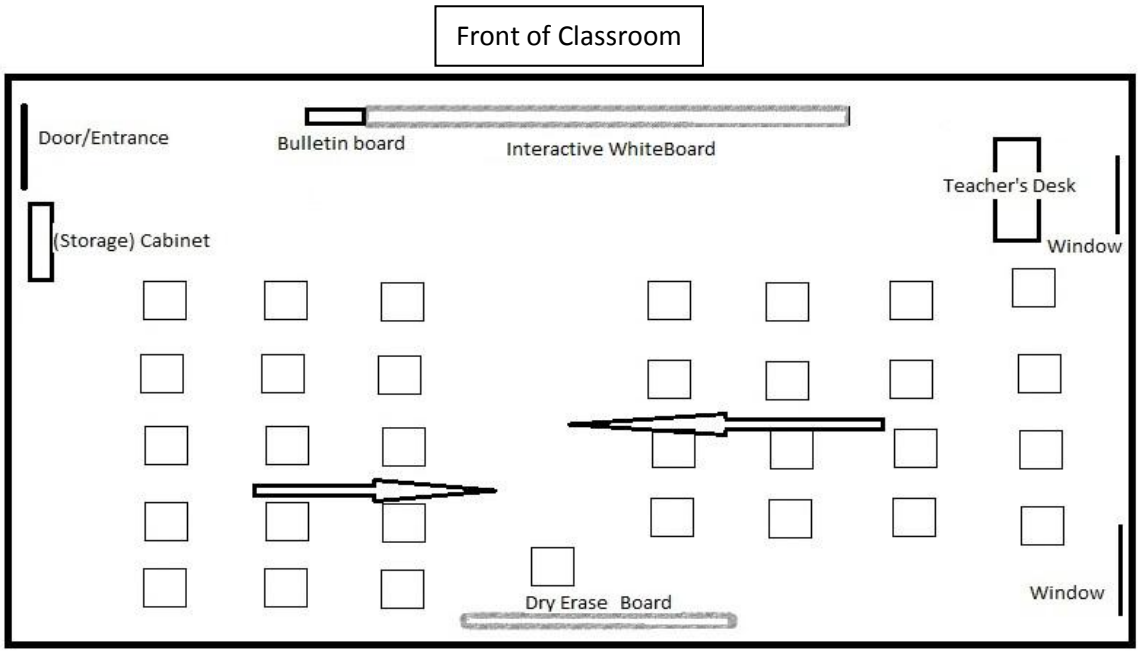

Figure 4.2 Diagram of Mr. Davis' Classroom (Arrows show the directions that the desks are facing.)

Ms. Smart is an African-American teacher, who is over 40 years old. She almost always dresses in business casual attire: dress pants, dress top, boots or heels, and matching accessories. She has a Masters of Education in Secondary Mathematics plus 30 hours in courses of mathematics content, technology, and special topics affecting students such as homelessness. She has taught for more than 20 years at Keller High School, which has 98% African American, 0.7% Caucasian, 1.2% Hispanic, and 0.1% Other students. She attended a public high school and a small, private, co-educational, liberal arts college for her undergraduate degree. She attended a large Research I university for her graduate degree. Ms. Smart presently teaches all grades in high school. She was raised in a predominantly African-American community in a city in South Carolina. She

searches the Internet and uses other resources such as her colleagues for ideas, studies, and examples of new and innovative ways to introduce, teach, and assess concepts and standards in her statistics classes. Ms. Smart listed the following things that she has done in her statistics classroom that have facilitated the academic success of her African American students: 1) the inclusion of a study guide, which requires students to read the chapter/book, 2) folders for each student/class, which helps keep the students organized and helps students not to lose their work, and 3) in her grading system, she has included credit for work/answers that may not be correct, but the effort and/or attempt has been made. Kitchens (2005) may have associated this with "Access to Opportunities to Learn Mathematics." Ms. Smart has an awareness of the need to encourage her African American students to participate during the lesson.

Ms. Smart is quoted as saying she treats all of her students "the same: firm, but fair." She does not show favoritism. She wants to be fair but not a pushover. An example occurred during an observation session when students were tardy for her class; her rule about being tardy is that students must bring a note and no one is exempt. Two male students walked into her first block class one day around 9:20 a.m., after class had started at 8:35 a.m.; Ms. Smart asked the students why they were late. From where the researcher was seated, the researcher could not hear their answers to her. Ms. Smart's response was that they were supposed to take care of whatever they were doing during Homeroom period. She asked why they did not do it then. She also asked, "Where are your notes?" They said, "Don't know." She said, "I don't know either," as they turned and walked back out of the classroom to go get tardy notes for her (Fieldnotes, 2/11/2014). Ms. Smart

cares for all her students; therefore, she has high expectations of them. Being on time for class is just one high expectation that she has of her students.

Ms. Smart's classroom is usually warmly-lit and family-like. The décor is multicultural. Ms. Smart has many posters depicting mathematics from different countries and cultures. Students' desks are arranged in a semi-circle formation, facing the front of the room (see Figure 4.3). There is an interactive white board and dry erase board at the front of the room. The teacher's desk, which holds Ms. Smart's main computer, is at the front of the room with two tables on either side, which gives students extra seating. There are lamps on the right, left, and along the back side of the room. There is a television mounted in the corner that displays the time of day at all times. In that same corner, there is a shelf and a high table with a computer on it. This is the teacher's work computer, the one that projects the data/material onto the interactive white board. The student teacher sometimes sits at this high table/counter area.

The researcher observed Ms. Smart's classes on an "A" day and on a few "B" days. The A/B plan of block scheduling means that classes meet every other day, for 90 minutes, for the entire year. In the three different Probability and Statistics classes (two different classes were observed on a "B" day and one class was observed on an "A" day) that the researcher observed, two classes had all African American students: 4th Block had 24 students (14 females, 10 males) and 1st Block had 15 students (8 females, 7 males). In the other 4th Block statistics class (on the "A" day), there were 23 students: 14 females, 8 males, and one White female.

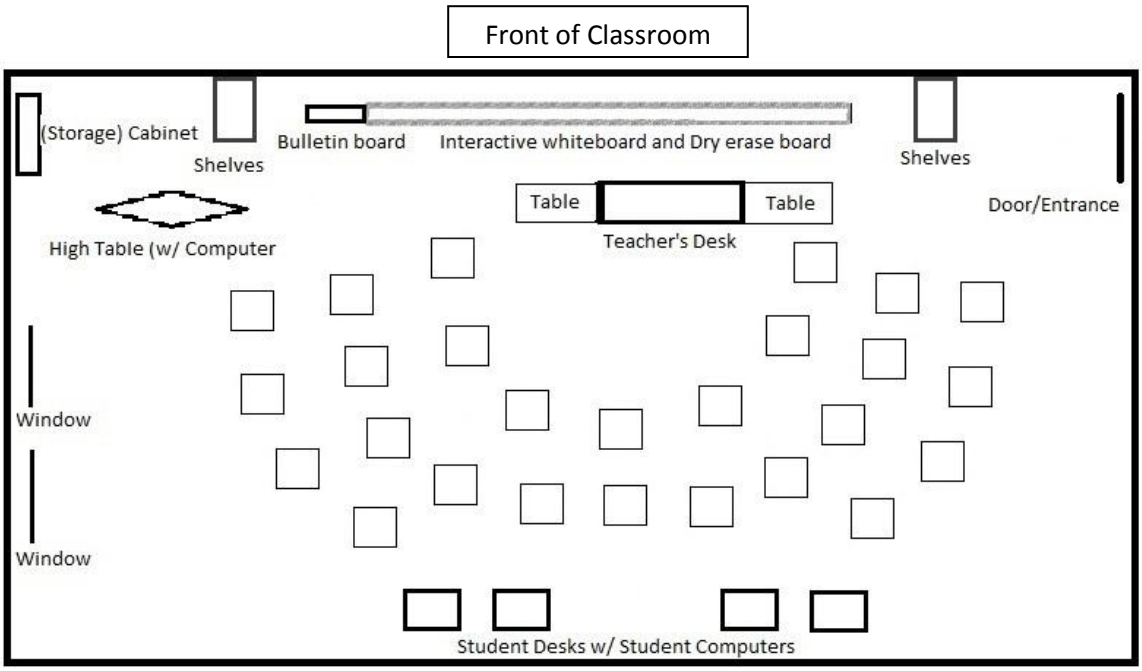

Figure 4.3 Diagram of Ms. Smart's Classroom

4.4 Culturally Relevant Pedagogy in High School-Level Statistics Classrooms

Culturally relevant pedagogy entails many things. Specifically, for this study, principals were asked to recommend mathematics teachers based only on the following four characteristics that are related to culturally relevant teaching: 1) teacher believes all students can learn, 2) teacher values culture and language of students, 3) teacher cares about all children, and 4) teacher sees their work as a calling and basically believes that they can make a difference in students' lives and communities. Teachers who use culturally relevant pedagogy create relationships that allow them to maintain focused environments while facilitating student development and self-esteem (Ladson-Billings, 2009). Culturally relevant pedagogy maintains that teachers need to be non-judgmental and inclusive of cultural backgrounds of their students in order to be effective facilitators of learning in the classroom (Brown-Jeffy & Cooper, 2011).

Typical mathematics instruction emphasizes whole-class instruction, with teachers describing a technique to solve a problem and students listening to the lecture. Students are then instructed to work alone on a set of textbook problems. However, with culturally relevant pedagogy, teachers take a different approach to teaching. Because teachers who use culturally relevant pedagogy are identified by the way they see themselves and others and how they structure social interactions, they are able to incorporate teaching behaviors that personify the characteristics (Ladson-Billings, 2009). Because these behaviors are examined in context, they may appear to intersect and overlap. This study attempts to show how these characteristics (teacher believes all students can learn, teacher values culture and language of students, teacher cares about all children, and teacher sees their work as a calling and basically believes that they can make a difference in students' lives and communities) are explored through observations of culturally relevant teachers in high school statistics classrooms.

4.5 Community Referents Perceived as Important in Conceptualizing Culturally Relevant Practices in a High School-Level Statistics Class

> **What community referents (social, economic, religious, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class?**

The community referents perceived as important were social referents such as sports (particularly basketball), local stores, and life experiences. When the researcher interviewed the teachers, here is what each one of them stated that they perceived as community referents that were useful in making connections to their students in teaching high school statistics:

> **Ms. Newman:** That is the best thing about stats. That is what I learned to like about stats. Besides any other course, I can really—I can take time and get to

know them and use whatever is important to them. Whether its football teams or politics, the fact that they are hungry and maybe they don't eat enough food, maybe they are starving. I don't know, whatever is relevant to them, the opportunity that I have is I can use that information and put it all together so they can, again, kind of look at it in a different perspective with a different filter on, you know? Data is really cool. It really is and they are always amazed with that. Especially when it's relevant to them or it's about them. That always gets them.

Mr. Davis: Well, that is a general concept. So understanding what results—like a marketing survey—may mean. Or understanding how differences in margins of error can be interpreted as far as the status of political races and that sort of thing. It's nothing immediate and it's nothing that really overpowers you. It's more general.

Ms. Smart: … So we look at all things like that. AIDS numbers and stats. Some of the diseases that affect our community like heart disease, high blood pressure, stroke, things like that. So, Stats is a good course to teach different things like that.

Ms. Newman mentioned football, politics, hunger, and any topic is relevant to the students. Mr. Davis revealed that he thought community referents that were perceived as important were marketing surveys and political races. Ms. Smart spoke of diseases that affect the African American community.

During the second day of observations with Ms. Newman, she defined "parameter" and "statistic" for the students. A male student did not understand the difference between the two concepts. Ms. Newman referenced an ice cream shop at a local shopping community of the students. The ice cream shop represents a social and perhaps an economic community referent. It is an appropriate community symbol. She told the student to imagine that she went to the ice cream shop and asked for a sample of ice cream. The conversation continued:

Ms. Newman: Does it give you a good idea of what the ice cream tastes like? If you rate it as good, then your rating of "good" describes the sample.

John (her student): You're getting the idea of the whole thing.

> **Ms. Newman**: Sometimes a sample pretty accurately describes the whole thing. Sometimes the sample is good enough to describe the population. But sometimes you miss out on something. What if you didn't get a chocolate chip or cashew in the ice cream? (Fieldnotes, 1/22/2014)

Ms. Newman used the ice cream shop as a community referent—a place the students are familiar with—to explain the idea of sampling.

During the second observation in Mr. Davis' class, he first began by reviewing sample means and asking students to tell him how to find the sample means. They began to discuss a problem from data that he had presented on the interactive white board: the average points per game by a sample of NFL teams. Mr. Davis then instructed the students to calculate "Σx, the sum of all the data entries." He read the instructions from the interactive white board: "What is n, the sample size, of the data set? What are the median and the mode of the data set? If the data does not have a mode, explain why." These data had been presented at the end of the NFL football season. Football was used as a social referent to teach statistical concepts.

Later, during that same class, Mr. Davis passed out a data set on a small sheet of paper for the classwork assignment. It was the scores of the winning teams from Super Bowl games. For this assignment, students were asked to create a frequency distribution with seven classes, calculate the mean of the data set, construct a frequency histogram, and identify the mean and median from the original data set. This assignment was given two days after the Super Bowl (Fieldnotes, 2/4/2014). Again, football was used as a social community referent to practice statistical computations.

On the last day of observations for Mr. Davis, he began the chapter on Probability. While explaining the Fundamental Counting Principle, he used choices or

options for football uniforms for a well-known South Carolina college. This is what he put on his interactive white board:

Helmet: Orange

Jerseys: White, orange, purple

Pants: White, orange, purple

Mr. Davis told his students to find the product of the number of options:

1 • 3 • 3 = 9 possible combinations.

This example used a football team of one of South Carolina's biggest rivalry teams. In this example, it seemed to the researcher that the students could understand the context and, therefore, better grasp the concept because the information was relevant to them (Fieldnotes, 2/21/2014).

The following tables give summary data on the number and types of referents used in the high school-level statistics classrooms during the observations. The referents were noted in most of the fieldnotes from the observations. From the data, the researcher found 81 mentions of referents (Table 4.2). From further examination of the data, the researcher found 50 community referents. An example of a community referent would be something that the students can identify with as being an important part of their community such as school events or recognition of popular sports events/teams (Table 4.3). An example of a non-community referent would be data on "Ages of Visitors" for some unknown place.

Table 4.2 Referents Used in High School Statistics Classes by Teacher

Teacher Participants	Number of Referents Used in H.S. Statistics Class	
	Community Referents	Non-Community Referents
Ms. Newman	23	5
Mr. Davis	11	14
Ms. Smart	16	12
Total	**50**	**31**

Table 4.3 Types of Community Referents Used in High School Classes

Teacher Participants	Types of Community Referents Used in H.S. Statistics Class				
	Social	Economic	Religious	Political	Total
Ms. Newman	19	3	0	1	23
Mr. Davis	9	2	0	0	11
Ms. Smart	13	3	0	0	16
Total	**41**	**8**	**0**	**1**	**50**

The next subsections present findings on teachers valuing the culture and language of the students and teachers seeing their work as a calling. These findings address this research question because these two characteristics are foundational for the teachers as they get to know the students while also learning about and using the community referents discussed to conceptualize culturally relevant teaching.

The teachers value the culture and language of children and their families.

Teachers should be aware of the presence and uses of mathematics in the students' communities. Using culture as the context to support statistical understanding requires that teachers learn about the culture of the community to be able to use it in the classroom. Mathematics teachers who teach statistics may encounter students with difficulties in understanding the topic, and it is helpful to relate statistical concepts to real-life situations. In observing three teachers, the researcher found all of them used real-

life situations to relate to statistical concepts. When talking about how to make a stem-and-leaf plot, for instance, Mr. Davis used the ages of siblings to demonstrate the technique. He humorously explained that his parents were "very old and his oldest sister was 57!" When Ms. Smart was discussing retrospective observational study, she compared it to retroactive pay for students who work; most students seemed to understand the meaning. Associating data to family is culturally relevant because students can relate to having family members who have numerous siblings with considerable age differences. Ms. Smart's example was mentioned because it is considered part of her students' culture to get jobs as teenagers to be a source of financial support in their household. Making content relevant to students helps facilitate the learning of statistics.

The teachers used culturally relevant data to introduce new statistical ideas and terminology. In their classes, the teachers must have high regard for the culture and language of their students in order to present multiple representations of learning objectives. The teacher participants used various methods to discover knowledge that their students bring with them to the classroom. Most of them mentioned that they simply spend time talking with students about what is important to them. They also found ways to find out what the students' interests are and what is really important to them. By listening and learning from the students, Ms. Newman, Mr. Davis, and Ms. Smart all understood the need to rethink and re-envision the curriculum of statistics and what they should do with it.

When the researcher asked the teachers about understanding the culture of their students, they had various responses:

> **Researcher:** Do you think that understanding the culture of students is important for improving students' academic performance in your statistics class? Explain.

Ms. Newman: Absolutely. It influences them, so of course it's going to influence them in my room and I have to respond to that. I also think that the culture of their environment makes a difference. I like to keep an eye on what is going on in their homes, just the issues they might be having, that kind of thing too. That helps me to help them better.

Mr. Davis: I do. I went to Fulton County High, which I believe at the time I was there it was predominantly, 90%, African-American. I was in Fulton County schools my whole life. And I was used to having relationships and being pretty close to Black folks my whole life. I do think that is obvious. I think my kids pick up on that while they are in my classroom. As far as improving academic performance, I think it makes them a lot more comfortable with me. I think it helps them trust me. And I think I do a pretty good job of trying to understand how some students who are still hesitant may see me approaching them. I'm pretty open with my students and just telling them—it's really funny to tell them things that I understand or don't understand. And they laugh at me, but all of that helps build a relationship and there is a strong correlation between teachers having relationships with their kids and their success.

Ms. Smart: Yes and no. I think it's important, but I don't think it's the most important thing. Again, if you are firm and fair and you treat everyone the same. And you try to bring in different situations, different things that anybody can relate to, whether it is a cultural thing, whether it's a gender thing, something that maybe women can relate to more so than men. And you make sure that everybody feels a part. If you try to bring in things, if you have a class full of athletes and you try to bring in some athletics statistics that they could relate to or they are interested in, but half the class may not be interested in that. Just try to find… knowing your students, knowing what they are interested in. Because everything isn't always just a cultural thing. Because the world is more than just—you know, when they get out into the world, it's going to be multicultural. Even though right now it might be one particular culture, it's going to be multicultural when they get out into the world. So I think taking that into consideration, but yet not focusing on that *only* as a means of how you are going to educate. (Interviews, 1/22/2014; 1/17/2014; 1/21/2014)

Each teacher acknowledged that the students' culture was important to understand but they each gave different reasons for why they felt it was important. Ms. Newman thought that culture was important to understand because it helps her help her students. Mr. Davis believed that being educated in a diverse school district has allowed him to appreciate the importance of understanding students' culture because it reflects a sincere trust and has

allowed him to establish a rapport with students that he otherwise may not have had. This trust is also expressed by the students toward Mr. Davis. In addition, Ms. Smart felt that culture was important to understand because culture guides how she educates her students. Culturally relevant teachers in high school-level statistics classrooms value the culture of their students and find ways to use their culture to enhance students' learning.

Another aspect of culturally relevant pedagogy is that students' home language is incorporated into the classroom. Kitchens (2005) asserted that the lesson has mathematical discourse and communication when most of the students (50% to 90%) for most of the time (50% to 90%) are engaged in mathematical analysis and verbal interactions. In Ms. Newman's class, she had a conversation with a student and when he understood what she was trying to explain to him, he replied, "Word." She continued with the lesson and at the end of class, when he asked another question; she responded, "Word" back to him ("Word" is used as form of acknowledgement or term of agreement). It was like a transfer of knowledge; she understood his language and used it to answer back to him.

African American students respond to teachers who use culturally familiar communication patterns, high expectations, and firm classroom management (Ross et al., 2008). All of the teachers used a "call-and-response" type of speaking in the classroom, which is a familiar communication pattern. In contemporary African American worship services, call and response is prevalent. Pastors will call out to congregants to engage an enthusiastic response. Just as pastors call out to congregants, skillful teachers call out to students to eagerly respond as they reply to questions in the classroom. This type of teaching method gives teachers immediate and constant formative feedback of students'

progress. Furthermore, when the teachers notice that particular students were not answering, the teachers can call on the students by name to check their growth in learning.

The teachers see their work as a calling and they can make a difference in students' lives.

These teachers of high school-level statistics classes see their work as a calling and believe that they make differences in students' lives and communities. When the researcher interviewed the teachers, the researcher asked them how they became mathematics teachers. Ms. Smart's major was computer science, but after she taught a class as part of a required elective, she changed her major to Mathematics Education. Mr. Davis said that it just came to him. Ms. Newman knew that it was in her heart—it was her calling.

Researcher: How did you choose math teaching as a profession?

Ms. Newman: …I love math and I have always been fond of children. I will be the one; I was the one always babysitting, teaching, tutoring, whatever. It just seems to be a part of my blood. When you talk about you do the thing that you love and people say, "Well, how do I know that I love it? How do I know what to do?" You know. I can't explain it. It's in your heart. I wouldn't do anything else.

Mr. Davis: I had a really good relationship with my high school football coach. It just so happened that he used to be a math teacher. He wasn't when I first met him but I just wanted to—understanding the type of role model he was for me. I have always been around schools. My mother was also a teacher, so I grew up being dropped off at the high school when I was young, to go home with her. And then my dad had several kids that he has mentored in his community and stuff. So it's really been—it was never something overbearing, like, oh, you are going to be a teacher, but it just kind of came to me as I was preparing to graduate.

Ms. Smart: …I prepared a lesson for them and I went in and I taught it. And just the reaction of the students in that class, like oh my goodness, you are going to be the best teacher! You are going to be the best teacher! I wish I had a teacher like you in high school. I was like, no, child, I'm not going to be a teacher. They were like, what? You need to be a teacher. You are good. You are good. I was like—and you know, just their reaction and I never understood it until you taught it—I

was like, hmmm. Then on top of that, not to date myself, but the computer science I was doing was way before the World Wide Web, there was no such thing as the World Wide Web at that time. It was just learning the basic languages. BASIC, FORTRAN, COBOL, and hardware and—there was no software at that time. It was just learning, you know—and it was boring. So that is what made me change my major to math education. So that is how I became a teacher. (Interviews, 1/22/2014; 1/17/2014; 1/21/2014)

All three of the teacher participants saw their work as a teacher as a calling. They all believed that they, along with students and their families, could make a difference in the students' lives and communities. The teachers believed that they could make a difference by contributing to the academic and personal growth of the students. In addition, question number 6 on the interview asked about how they saw teaching as a way of giving back to the community:

Researcher: Some teachers see teaching as a way of giving back to the community. How do you use teaching as a way of giving back to the community and how do you encourage your students to follow the same sentiment?

Ms. Newman: There are so many teachers who do so much good. They go out and get involved in the community and touch base with the community and I try to do that too, but sometimes I think my gift—my gift is trying to put out this young person who is a little better. I want parents to see me as not the enemy but this person who is working with them to raise this one little awesome human being, you know? Who has values and character. I think that is my gift to community.

Mr. Davis: Well, teaching is a way of giving back to the community because we are taking care of their kids. We are taking care of the kids who will go off and do great things and then we are also taking care of the kids who will be in this community for the next 60-70 years. So really, that is like the ultimate gift—just taking care of them, educating them. I don't do anything that I am aware of specifically to encourage my students to follow this sentiment.

Ms. Smart: I feel like I am preparing them—I'm giving back to the community because I'm preparing the next generation of doctors, the next generation of lawyers, the next generation of plumbers, the next generation of construction workers. I'm preparing them to be ready to go into society and be productive citizens. Another way of giving back, because we are more than just teachers to our students. For a lot of our students, we provide them the stability and the structure that they may not see somewhere else. So they look forward to coming

> to school because they know what to expect. And for a lot of our students, we are the moms, we are the guidance counselors, we are the person they can talk to if they have nobody else they can talk to. We are the shoulder to lean on, cry on, so hopefully—and I know that I have—but hopefully I have touched someone in a way such that they feel compelled to do the same thing for somebody else. And I know I have because I had so many of my babies come back teaching here with me or told me that they wrote about me in some college paper. Or I had a friend who was reading for the Praxis and recognized the name of the person who the paper was written, because they had written their name and written my name and said that I was the reason why they were trying to become a teacher. (Interviews, 1/22/2014; 1/17/2014; 1/21/2014)

All of the teachers felt that their way of giving back to the community is to contribute to the future of the community and to help make their students better, greater human beings.

4.6 Classroom Social Relations

> **How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics class?**

The teacher-student relationship in a culturally relevant classroom is flexible and non-discriminatory. The range and variety of areas in which the teachers ask their students to provide leadership is wide (Ladson-Billings, 2009). Teachers may ask about language or statistics, or they may request details about student culture. For example, a teacher may ask about the words of a popular song or what they mean. The students are not accustomed to seeing the teachers take on the role of student and themselves in the role of a teacher, yet they seem at ease with this role reversal (Ladson-Billings, 2009).

Culturally relevant teaching encourages students to learn collaboratively and anticipates that they will teach each other and take responsibility for each other. Culturally relevant teaching promotes the kind of cooperation that leads students to believe they cannot be successful without getting help from others or without being helpful to others (Ladson-Billings, 2009).

An example of how students interact and help one another was in Ms. Newman's classroom. She looked at her roster to call on a student. When the student answered, Ms. Newman asked the others, "What do you think? Do you agree?" The class responded; this demonstrated how students were helpful to the first student that she called on (Fieldnotes, 1/22/0214). Another example of students interacting with one another and getting help from each other was the day Ms. Newman took the students outside to do a data-collecting activity. First, the students watched a video (Hoang, 2010). Ms. Newman asked students what they thought were the reasons why we cannot walk straight. Next, Ms. Newman gave instructions on how they were going to do the activity to collect data. Then she and her class went outside to the track field to do the activity and record distances (Fieldnotes, 1/23/2014).

Students were asked to work with partners. The partner was supposed to tie a blindfold around a student's head to cover the eyes. The blindfolded student was supposed to walk in a straight line. The partner was told to note the spot, using a tape measure placed on the ground, where the person stopped walking in a straight line. Students took turns walking, making sure that their partners started in the proper spot. Other students in the class helped the partner mark where they thought the person started drifting. Classmates yelled "Stop" to other classmates when they walked a good distance from where the data was being collected. For a few students, they let them continue to walk to see how far they would go and if they would start to walk in a circular pattern (Fieldnotes, 1/23/2014).

This data-collecting activity demonstrated two things: the type of interaction between teacher and students and the interaction among students. The teacher did not

have to reprimand students for not doing what she asked. They followed directions and all participated. They helped and laughed at each other. When all of the students had completed the activity, the students asked Ms. Newman (and the researcher) to do it also. Because of the trust and the relationship with the students, Ms. Newman gladly obliged. The teacher, for a moment, became a student as the students briefly took on the role of teacher.

Mr. Davis kneels down at his students' desks to ask them to explain a problem. When they call him over to their desks for assistance, he gets down on their level and asks the students to explain what they know to him. He then walks them through the problem to help them reach the answer they are seeking from him (Fieldnotes, 2/4/2014). Mr. Davis also encourages student-with-student interactions. He would almost always say something like, "You can do this on your own. Check with someone beside you to make sure you're on the right track" (Fieldnotes, 1/27/2014). Students were encouraged to be helpful and to seek help from others.

Ms. Smart also demonstrated a genuine relationship with her students. She talked to her students like they were her nieces and nephews, her extended family. She would say, "Go to Ms. Hinson, baby," "Yeah, baby," and "Thank you, sweetie, I missed you too" (Fieldnotes, 2/5/2014; 2/6/2014). The last comment was what she told a student who told Ms. Smart first that she missed her. It was a sweet tone, nothing inappropriate. At the end of a class, a male student said in a strong, loud voice, "Are you taking this up?" Ms. Smart just gave him a look and he got very quiet as if he understood that she was not in a playful mood (Fieldnotes, 2/7/2014).

While the students were working on a "Do Now" problem, a female student was at the front explaining a problem. The screen moved down and she could not quite see the problem the way it was originally. She tried and tried to fix the screen. Another student had to instruct her how to use the scroll bar to move the screen back up (Fieldnotes, 2/7/2014). Ms. Smart also sat at a desk to help students, allowing them to verbalize the problems and explain the solutions.

Communities of learning can be developed in classrooms by making conversation normal classroom practice. Culturally relevant teaching encourages students to learn collaboratively. The way the classrooms were organized and how students were seated made collaborative learning an effortless task. Students were able to shift desks or move themselves to create groups of two to four.

The table below (Table 4.4) summarizes the types of interactions in the high-school level statistics classrooms where the teachers utilized culturally relevant practices. The data showed that there were largely more academic-type interactions than social interactions. From an examination of the data of teacher-student and student-student interactions, both types of interactions helped to implement culturally relevant practices in the classrooms.

Table 4.4 Types and Number of Interactions in the High School Level Statistics Classes

	Teacher-Student		**Student-Student**		
Teacher Participants	Academic	Social/Other	Academic	Social/Other	**Total**
Ms. Newman	31	7	14	10	62
Mr. Davis	35	5	14	4	58
Ms. Smart	41	15	16	9	81
Total	**107**	**27**	**44**	**23**	**201**

In Ms. Newman's class, students were given an assignment where they had to choose to do tasks using their Senior Survey Data. Students worked on their assignments with partners. A few students worked alone. However, the ones that worked alone had no problems with asking their classmates for help when needed. For instance, one male student could not remember the details of a stem-and-leaf plot. He looked around and then walked over to another male classmate to ask. The student aided him by explaining what a stem-and-leaf plot looked like. The student who was perplexed went back to his desk and continued to work. In another instance, a female student (sitting alone) asked a male, "What did you get for the mean?" He replied, "60.86." She said, "Yeah, I'm going to round up," as she continued on with her work confidently (Fieldnotes, 2/5/2014).

Mr. Davis continually encouraged students to work together and to discuss classwork assignments. For example, during one observation session, Mr. Davis told his students, "Just to be sure you're on the right track, check with someone near you to make sure you have the same classes and tally in each class." Students talked. A male student asked about how to find the lower limit of a class. As a student beside him started to explain, Mr. Davis went over to the student to comment on his question. During another observation, students got in groups of two to four people to work on the Student Height Data Set to find mean, variance, and standard deviation. Mr. Davis reminded students why they were allowed to work collaboratively by saying, "You're in groups for a reason. Make sure you're communicating."

In Ms. Smart's class, her students frequently helped each other. Just during the third observation alone, the researcher saw one student help four or five others during the "Do Now" portion of the class. The "Do Now" problems were problems that were on the

interactive white board for students to **do now**, at the very beginning of class. The "Do Now" activity in and of itself is a culturally relevant factor because it holds high expectations that students will begin to work as soon as they enter the classroom. A male student first got up to help another male student who did not seem to remember how to find slope or x- or y-intercepts for a line, given the equation. After he walked the first student through the steps to solve these problems, he moved on to help two female students. Ms. Smart allowed a student to go to the front of the class to work the problem on the board. While the female student was at the front, the male "helper" student walked to the other side of the room to check on another female student as she was working on the problem (Fieldnotes, 2/7/2014). The male "helper" student began helping students on his own as they would go to him for help when Ms. Smart was busy. Ms. Smart also used his help often with students who may have been absent or just may not be catching on as quickly as others.

After a student passed out a handout to work on for classwork, students started working on the assignment in groups of two to four people. The male student "helper" who helped others was moving from group to group to offer his assistance. He stayed at one group with four girls for about 10 minutes. He told the girls to write "Double- or single-blind because she (teacher) will take it." But then the helper asked the female student if she knew the difference and she told him what the difference is between single- and double-blind experiments. The female student told the male student that a single-blind experiment was when the subjects did not know what type of treatment they were receiving; double-blind, she said, was when the researcher and subjects both did not know which subjects were receiving what type of treatments. The two of them then

quietly gave each other a high-five (Fieldnotes, 2/7/2014). The teachers believe all students can learn and care about all students too. Both of these characteristics influence the range of classroom interactions.

The teachers believe all students can learn.

Teachers need to help students master some non-mathematical elements of statistical thinking such as identifying problems, creating plans of attack, and gathering necessary data. Ms. Newman wanted to create a survey about the opinions of 17-year-old students. She asked her students to give her the steps and to explain what she would have to do to carry out the survey. Mr. Davis inquired of his students when they were creating a frequency histogram on the age of visitors at a home basketball game during a certain time period. When drawing, he asked if the data started at zero. The students told him that his axis for his histogram needed a 'break' to show that the data does not start at zero. Along with these examples, Ms. Smart's lessons focused on observational studies and experiments; therefore, the majority of her lessons were about identifying problems, creating plans, and deciding how to gather necessary data. These examples highlight the statistical content as well as culturally relevant teaching aspects by using data that are relevant and familiar to the students.

One of the questions in the teacher interview asked teachers about their belief of students' learning successfully.

> **Researcher:** Do you believe that all students can succeed and achieve? Why or why not?
>
> **Ms. Newman:** Well, yeah. That is me. Absolutely. It's not always my definition of achievement. Like, sometimes we have to meet them where they are and go from there and help them feel better about what we might think is a very small thing, but man, I know to them it feels good when you get something. Yeah, I do

think that. I'm not the one always to pull the boat, but they got to do their part. But they can do it. Sometimes I think they forget that they can do it.

Mr. Davis: I do believe that all students can succeed and achieve, but I don't think we can measure success the same way for each student. I have a tough time believing that every child that comes in my classroom can end up at the same point upon leaving, but I do not think it's unreasonable to think that every child that comes into my classroom can get better while they are in here.

Ms. Smart: Yes. Because everybody has a brain. So if you are sitting in a desk, you have the capability to learn. So learn.

Referring to the observations, this same characteristic was confirmed when the teachers showed that they believe all students can learn by constantly presenting questions to all of the students (call and respond), making an effort to leave no one out of class discussions, and by having high expectations of all of their students.

Ms. Newman's cultural conviction does not permit her to see students as failures. When she was asked about her expectations of her African American students, Ms. Newman referenced her culture and why she expects African American (Black) students to be successful in the learning process:

Researcher: What are your expectations of your African-American students compared to your other students?

Ms. Newman: My expectations—I think I want to say the same. But a part of me, just who—I'm from India and a part of me teaches with the idea that, look, my parents came here, they gave up a lot to come here to this country and I'm not about to blow it for their sake. That blood runs in me. I want them to realize that all of my other—I don't care if you are Black or White or Indian or what, you can do it. You can do whatever you want here.

In addition, Mr. Davis and Ms. Smart expressed that they had the same, if not higher, expectations of their African American students when it came to asking about them being successful in learning statistics.

Researcher: What are your expectations of your African-American students compared to your other students?

Mr. Davis: They are all the same. I just look at my kids as students in my classroom and I am responsible for teaching them and they are responsible for hopefully meeting me halfway. But it's no different than any other student I teach.

Ms. Smart: Actually, I don't have that many *other* students.… But my expectation for all of my students is that they are all successful and they work to their highest ability level.

Referring to the answers in their high expectations interview questions was another way that the researcher confirmed that the teachers believed all students could learn.

The teachers care about all students.

A caring attitude shows students that the teacher has their best interest in mind. All of the teacher participants showed they cared by making sure students took notes on examples, definitions, and important information. Ensuring that all students were taking notes showed that the teachers cared about the students getting the necessary information to study statistical terms and concepts. In addition, Ms. Newman expressed her caring attitude by allowing a student to come to class late because she knew that the student has some type of unfavorable home-life situation. Ms. Newman told the researcher that she had already spoken to a guidance counselor at the school about the student's situation so that they are aware of the multiple tardies. Ms. Newman also expressed how much she cared for her students verbally. When students answered questions correctly, she would say, "I love you, Layla" in a motherly, excited tone. This let the students know that she was happy and proud that they had answered the question correctly (Fieldnotes, 1/22/2014).

Mr. Davis touches his students on the arms or shoulders to let them know he is "there for them" and to check their progress while working in class. A student asked Mr. Davis for a pencil. He got a pencil out of his cabinet. The student said that the pencil was not sharp enough for her. Mr. Davis went to sharpen the pencil. When he returned the pencil to her, he asked, "[Is it] Better?" (Fieldnotes, 1/27/2014). This example is mentioned because it shows that Mr. Davis cared enough about the student to make sure that she had the necessary supplies to complete her assignment. Another thing that the researcher noticed in Mr. Davis' classroom was that he provided a place for students to keep their textbooks. There is a locker rental fee at the school. For students who did not have lockers, Mr. Davis allowed them to keep their books on top of his cabinet. When it was time to do classwork from the book, the male students would stand in a chair, reach on top of the cabinet, and get their book or classmates' books. Again, this was a way to ensure students that they would have the necessary supplies to learn in his statistics class (Fieldnotes, 2/21/2014).

Ms. Smart recognized students' birthdays in her classroom. She wished and told her class to wish a student an early "Happy Birthday" and a belated "Happy Birthday" to another. After that, a male student yelled to her (Marcus is his pseudonym).

Marcus: "Y'all didn't wish me a Happy Birthday for my birthday."

Ms. Smart: When was your birthday?

Marcus: Saturday!

Ms. Smart checked her students' birthday calendar and confirmed that, indeed, Marcus's birthday was Saturday, February 1st (Fieldnotes, 2/7/2014). Ms. Smart pinches student when they misbehave. When one of her male students cursed out loud in her

class, Ms. Smart told him to come to her. He seemed afraid to get close to her, but when he got close enough, she grabbed his coat and pinched his back once or twice. This was culturally relevant because she cared enough not to let him disrespect the other students by cursing and by telling him that he should not do it (Fieldnotes, 2/11/2014).

Another way Ms. Smart shows that she cares is by showing that she is committed to helping all students achieve. On a day when students reviewed for a test, she passed out papers that students had previously turned in. She gives credit for students' attempts. She said, "These are graded for completion, not correctness. [But] You need to make sure that you have the correct answers for the test." (Fieldnotes, 2/18/2014). In the teacher interview, she also expressed similar sentiments about grading students' work:

> **Researcher:** One of the reasons you were asked to participate in this study is because you are regarded as a teacher who is deeply committed to helping all students achieve. How do you show students or parents that you are deeply committed to helping all students achieve?
>
> **Ms. Smart:** I try to design my course so that every student, regardless of their ability level, is able to understand the material and able to participate in the discussion and the activities and the lesson. I try to make my grading such that everybody has a high chance of being successful. And if you talk to any of the kids, they will say it should be hard to fail this class. Even though some do, it's hard; they have to try to fail.

This chapter provided examples of culturally relevant teaching in a comprehensive manner by way of demographic data of teachers, interview responses, and observational field notes. It also provided some excerpts from a typical day of culturally relevant teaching in a high school-level statistics classroom. Triangulation of data from interviews, observations, and field notes further illustrated culturally relevant statistics teaching. The next chapter provides a summary and discussion of the study. The

researcher also offers suggestions for future studies with culturally relevant teaching in a high school-level statistics classroom.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

5.1 Summary

Chapter Five provides a summary of the study goals and methods, a summary of the conclusions, and discusses pertinent avenues of additional research and implications for educational improvement. As the American student population of the 21st century continues to become more heterogeneous, it is imperative that educators respond by developing more sensitive and sophisticated teaching skills to accommodate all students in their multi-cultural classrooms. According to the U.S. Department of Education Institute of Education Science (IES), enrollment of racially and ethnically diverse students is expected to increase in the next decade while enrollment of White students will proportionally decrease. Schools must be ready to welcome this wide range of learners in order to achieve their mission of preparing the future generation of citizens with those high-level skills necessary to participate and succeed in a knowledge-based society (Darling-Hammond & Berry, 1999). Currently, a disproportionately high percentage of minority and immigrant children perform generally lower academically than White, middle-class students (Gutstein, 2003). This disparity must be addressed by evidence-based reform of our pedagogical practices to improve the chances of school success for underachieving student populations (Howard, 2003).

Culturally relevant pedagogy is an essential component of reforming curricula in order to make the learning process more directly relevant to each student by

incorporating the child's culture into the educational process. This pedagogical method emphasizes the need for learning material across all subject domains to be culturally specific (King et al., 1997). Furthermore, the method provides a framework for teacher educators to reconceptualize the methods by which new teachers are trained and how to provide those new teachers with the skills and knowledge to improve the educational experience of minority students in the present (Ladson-Billings, 2009) while effectively educating and preparing them for success in the future (Howard, 2003).

This dissertation explored the ways in which culturally relevant teaching pedagogy was enacted in predominantly African American high school statistics classrooms. Specifically, this qualitative study of three successful high school statistics teachers of African American students investigated the teachers' perceptions and enactments of culturally relevant pedagogy. Culturally relevant teaching practices are needed in the statistics curriculum to address the academic needs of African American students. The particular setting for this study, a high school-level statistics classroom, presents a distinction to the existing literature concerning African American students and culturally relevant pedagogy. A majority of the studies to date have discussed contexts in the elementary and middle school settings, but not at the high school level.

Qualitative research is a proper method to gain insight, discovery, and understanding from the views of those being studied and to make contributions to increasing the knowledge of practices that is improving African American students' academic efforts. Multiple methods of collecting data were employed, including qualitative approaches to address the research questions. The types of data collection

utilized in this study were demographic data sheets, teacher interviews, classroom observations, and researcher field notes. The following questions were addressed:

1. What community referents (social, economic, religious, historical, or political) are perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class?

2. How do classroom interactions affect the implementation of culturally relevant practices in a high school-level statistics class?

This study was conducted in three phases. Phase One of the study consisted of getting approval to conduct research, obtaining teacher recommendations from principals, and making contact with potential teacher participants. After the researcher received Institutional Review Board (IRB) approval, the principals were asked to identify teachers who might give consent for participation. The researcher aimed to identify ***mathematics teachers who teach statistics*** and possess the following characteristics:

- The teacher believes all students can learn.
- The teacher values the culture and language of children and their families.
- The teacher cares about all children.
- The teacher sees their work as a calling; that means they believe that together with the children and their families, they can make a difference in children's lives and their communities.

These four criteria were cited in Ladson-Billings' (2009) book as she discussed characteristics of teachers who practiced culturally relevant methods (p. 28). Based on recommendations from the doctoral advisory committee, the researcher ultimately used

convenience sampling and limited participation to three teachers for study feasibility and data management.

Phase Two involved collecting data through data sheets and participant interviews. Phase Three included classroom observations. The data sheet was used to collect descriptive data. The teacher interview focused on the knowledge and awareness of teacher participants about culturally relevant pedagogy and how their experiences shaped their teaching practices. The teacher interview and data sheet were informed by research from Kelly-Jackson (2008), Ladson-Billings (2009), and Sanders (2001). Phase Three involved classroom observations of the three teacher participants.

Limitations

As with any research study, there are limitations that must be acknowledged. Ladson-Billings (2009) and other researchers (e.g., Gutstein et al., 1997) used recommendations from principals and parents to seek out participants for their studies. For the present study, the researcher was only able to solicit and use the recommendations of principals. Another limitation of this study is that this study had three teacher participants from a specific area of South Carolina; the results may not be generalizable to other areas of South Carolina or other areas outside of South Carolina.

5.2 Conclusions

A number of conclusions were formulated from analyzing the qualitative data from this research study. Most importantly, this study offers the first evidence that culturally relevant pedagogy can be demonstrated in a high school-level statistics classroom. Teachers who practice culturally relevant teaching in high school-level statistics classrooms believe all students can learn, value the culture and language of their students and their families, and care about all students. These teachers also see their work

as a calling and believe that they can make a difference in students' lives and communities. These teachers were skillful in their use of social and political community referents to conceptualize culturally relevant teaching in high school statistics classes. The caring teaching methods used in the classroom along with collaborative learning in high school-level statistics classes fostered a positive learning environment in which students were able to move towards success in learning statistics.

Community Referents: Teachers value culture and language, see their work as their calling, and identify community referents.

Another conclusion of this study is that the teachers of high school-level statistics classes value the culture and language of their students and their families. Culturally relevant pedagogy builds on the fact that learning may differ across cultures and teachers can enhance students' success by acquiring knowledge of their cultural backgrounds and translating this knowledge into instructional practice (Irvine, 2010). The teachers in this study stated that they took the time to get to know their students; they inquired about their students' culture and language that they used.

Teachers of high school-level statistics classes saw their work as a calling and believed that together with the students and their families, they could make a difference in students' lives and their communities. Good teaching starts with good relationships (Ladson-Billings, 2009). All of the teachers in the study seemed to love high school teaching and their students. In their interviews, these teachers expressed an internal desire toward their line of work. Effective teaching involves in-depth knowledge of both the students and the subject matter. The teacher must be a translator and a mediator who brings the subject to the students who, in-turn, must be able to express their understanding of the subject matter. Teachers who see their work as a calling find

creative ways to communicate statistical principles so that students understand the principles at their levels. The teachers in this study confirmed that they could move the students to statistics and move statistics to the students. For example, when the young man in Ms. Newman's class understood the statistical concept of qualitative and quantitative data, he said "Word." By him making this expression, she had brought him to statistics and statistics to him. This was like an "Ah-ha, I got it" moment (Fieldnotes, 1/22/2014).

Because the teachers in this study valued the culture and language of their students, they were able to get to know the students and find out about their students' interests. They were also able to find out what things were relevant to their students. For the first research question, the data analysis revealed that community referents perceived as important in conceptualizing culturally relevant practices in a high school-level statistics class were generally social community referents such as sports- and student-centered data. Although using sports- and student-centered data as social community referents may be a common practice in classrooms, little research has been published to support the use of this strategy. When the researcher interviewed the teacher participants, Ms. Newman and Mr. Davis said they used political community referents in their statistics classes. However, during the observations, the researcher was not able to obtain much data on political community referents. During the observations, the only political reference mentioned was the Confederate Flag debate in South Carolina. The Confederate Flag debate could simultaneously be manipulated as an additional community referent that could possibly be used to empower students to use and value data as a means for equity. Non-community referents were also noted in the observations. The researcher did

not observe the teachers using religious or historical referents in the classroom to make connections to their students in teaching high school statistics.

The use of social interactions in culturally relevant statistics classrooms: Teachers believe all can learn, care about all.

For the second research question, data analysis revealed that social interactions between the teacher and students and among students make it possible for culturally relevant practices to be implemented in a high school-level statistics class. Interactions in the classroom make it possible for the teachers to structure social relationships. The ways in which the teachers manage the social structure and classroom culture affects their students' willingness to work toward a common goal (Ladson-Billings, 2009). Classroom interactions essentially allow teachers to effectively implement culturally relevant practices in high school-level statistics classes. In reference to the teacher-student interactions, it appears that teachers' cultural knowledge allows them to effectively communicate ideas to students. Teachers can communicate to the students their genuine care and that they have their best interest in mind.

Call-and-response type of questioning is also used in the classroom. Some may be concerned that students may "fall through the cracks" because students who do not know the right answer will be silent or students who say the incorrect answer will not be heard, but call-and-response supports the tenets of culturally relevant teaching because it uses the cultural structure of familiar African American church interactions to enhance academic and social achievement. Teachers also supplemented the call-and-response method by checking in on students individually to also assess individual student understanding. In Mr. Davis' classroom, after asking the whole class a question, he looked at "Dwayne" and asked him if he was "good" to make sure he understood the

concepts that he was reviewing (Fieldnotes, 2/04/2014). In addition to this type of interaction, teachers used their relationship with students to enhance the learning environment. "It has been shown that successful teachers of African American students often use their cultural knowledge to refer to metaphors and family ties when presenting material, indicating a strong, almost familial relationship with their students" (Bonner, 2009, p. 4; see also Ladson-Billings, 2009). The researcher witnessed familial-type relationships with teachers and students in Ms. Smart's and Ms. Newman's classrooms. For example, in Ms. Smart's class, she showed that she cared by the way she talked and communicated with her students. She spoke to her students with respect and called them "Baby" and "Sweetie".

Caring attitudes are complemented by a demanding and strict environment. This type of instruction is said to evoke positive responses from African American students (Bonner, 2009). Under the idea that culturally relevant teaching encourages a community of learners and promotes students learning collaboratively, most of the assignments allowed students to work collaboratively with a partner or in a group. As teachers encourage students to learn collaboratively, they also expect them to teach each other and take responsibility for each other (Ladson-Billings, 2009). For example, when the students did the outdoor assignment in Ms. Newman's class, the students were responsible for the well-being of the blind-folded student (Fieldnotes, 1/23/2014).

According to Ladson-Billings (2009), when teachers promote communities of learners, they teach students that not only is it considerate to care about one's own learning but it is also benevolent to care about their classmates' achievements. The spatial patterns of the students' desks encouraged cooperation. The desks in the classrooms were

arranged so that students could easily move them to work with others. Social interactions amongst students were encouraged and supported by culturally relevant teaching in the high school-level statistics classrooms.

An additional conclusion is that the teachers in high school statistics classes believe that all students can learn. All of the teachers in this study demonstrated the belief that all of their students could succeed. The data presented in Chapter Four, such as directly related (and unprompted) statements in the interviews and teachers constantly asking questions of the students and having high expectations for all, document some ways in which they demonstrated their belief that all students could be successful.

The researcher noticed African American students actively participating in classroom discussion and interacting with the teacher and other students a number of times during the observation sessions. When students are treated as competent, they are likely to demonstrate competence (Ladson-Billings, 2009). In all of the classrooms that the researcher observed, the teachers of secondary level statistics classes treated the students as competent learners and the students demonstrated their competence in how confident they were in answering the questions.

Another conclusion of this study is that teachers in high school statistics classes care about all of their students. Having a true, caring relationship with students made it possible for the teachers to get to know what their students' interests are and what kinds of information the students could relate to. Ms. Newman, Mr. Davis, and Ms. Smart demonstrated their care for all of their students daily in the ways that they taught and how they conducted everyday activities in their classrooms. They were firm with students, yet they expressed genuine care for students' well-being and academic success.

An additional element: Students caring about students.

An additional and novel conclusion of this study is that students in high school statistics classes that are taught by teachers who use culturally relevant teaching seem to care for each other. Data from this study indicated this fifth aspect of a culturally relevant classroom in addition to the four characteristics of a culturally relevant teacher encompassed in this study, which replicates and extends the previously published results of Gutstein et. al (1997) and Ladson-Billings (2009). Ladson-Billings wrote about cooperative learning that encourages collaboration in the completion of assignments (2009). There were several observed activities such as the outside activity in Ms. Newman's class (Fieldnotes, 1/23/2014), classroom assignments in Mr. Davis and Ms. Smart's classes (Fieldnotes, 2/6/2014; Fieldnotes, 2/7/2014), and review work for Ms. Smart's class (Fieldnotes, 2/18/2014) that adopted aspects of cooperative learning. However, the researcher did not find previous studies that revealed real, caring relationships in secondary classrooms. Student cooperation, mutual responsibility, and respect were demonstrated daily in the classrooms of the teacher participants. Some specific examples of cooperation and shared responsibility for group learning were mentioned above in the discussion of classroom social relations. These examples included students assisting each other with a data collection task, reminding each other of definitions of statistical or graphing concepts, and checking with each other on the accuracy of their step-by-step calculations during an in-class assignment.

Culturally relevant teachings in high school statistics classrooms nurture the kind of social interactions in the classroom that support caring students. Students seem to feel a part of a mutual effort designed to stimulate academic and cultural excellence. The

students care for each other; therefore, they assist, support, and encourage one another. Hence, it is in the best interest of all students to make sure that the others in the classroom are successful.

5.3 Discussion

This study aimed to examine teaching practices from high schools in the Midlands and Santee-Lynches regions of South Carolina and to note the similarities and differences to those at elementary and middle schools in previous studies (Goldston & Nichols, 2009; Irvine, 2010; Tate, 1995). Most of the teachers participating in previously conducted studies were teachers at predominantly African American schools (Tate, 1995; Goldston & Nichols, 2009). Because of this information found while reading the research literature on culturally relevant pedagogy, the researcher chose to use a high school setting and tried to use schools that served predominantly African American students. Even though all of the teachers chosen were not at schools that served predominantly African American students, the classes that the researcher observed were Probability and Statistics classes populated by predominantly African American students.

The researcher noted several similarities between this study and previous studies on culturally relevant pedagogy. One similarity that was noticed between studies on culturally relevant teaching in a high school (Caron, 2006; Enyedy & Mukhopadhyay, 2007) and studies conducted in elementary and middle schools (Goldston & Nichols, 2009; Gutstein et. al, 1997; Ladson-Billings, 2009; Matthews, 2003) was that the focus of the classroom was instructional. Although a classroom is a multidimensional and dynamic place, the primary responsibility must be to teach. In culturally relevant classrooms, instruction is most important. In culturally relevant classrooms of high

schools and elementary/middle schools, effective teaching involved in-depth knowledge of both the students and the subject matter. Other similarities included the main findings: teachers demonstrated that they cared for all students, believed all students could learn, valued the culture and language of their students, and believed their work was a calling. The findings support that the results of Ladson-Billings' research (Ladson-Billings, 2009) also hold true at the high school level.

The researcher also noted differences between culturally relevant teaching in high school statistics classes and teaching in elementary and middle schools. One such difference was simply the subject matter. In the elementary level, culturally relevant teaching has been discussed for language arts, mathematics, science, and social studies. The fact that elementary teachers are responsible for educating various subjects is but a minute difference.

Another difference between this high school-level study and previous elementary and middle school studies was the fact that students in the high school setting sat at individual desks and in the elementary and middle schools the students typically sat at large tables. Because the students being observed in this study were not seated at tables, the teachers had to make an effort to develop communities of learners. In order to make the community work, teachers likely had to work harder to foster the collaborative nature of the class that supported the cares-about-all culturally relevant element. Both of these seating arrangements, nevertheless, can foster collaborative learning.

Community referents that were perceived as important in conceptualizing culturally relevant practices in high school-level statistics classes in this study were generally social community referents such as sports and student-centered data. This study

was conducted in a high school setting. This is a generation of technology and social interactions. Therefore, social matters were relevant and useful in teaching statistics to these present-day teens. The researcher may not have witnessed much teaching using political referents because of the timing; there were no local, state, or federal elections or major issues at the present time. In this research study, the teacher participants differed in gender and ethnicity. There were two women and one man included in this research study. There was an Indian female teacher, a Caucasian male teacher, and an African American female teacher in this study. In addition to the participants' difference in gender and ethnicity, they also differed in their styles of caring relationships. The female participants seemed to have a more familial-type relationship with their students. The male teacher participant had more of a "concerned, close family friend" type of relationship with his students. Nonetheless, there were fundamental similarities found across all three in terms of culturally relevant teaching. As mentioned previously, they all cared for all of their students, believed all students could learn and succeed, and valued the culture and language of students and their families. All of the teachers saw their work as a calling and believed they could make a difference in their students' lives.

The findings of a high school-level statistics class are probably different from those of another high school mathematics class. In statistics, it is common to use data. Therefore, a key feature that may be different would be the ability to use student-centered, self-created data. In a high school statistics class, students can collect various kinds of data about themselves and apply it to various statistical concepts.

Another reason why the findings may be unique to a high school statistics classroom would be the actual content of the course. Geometry, Algebra I & II,

Trigonometry, and Calculus courses would all present different types of mathematics. Therefore, the findings from a study in a high school statistics classroom would likely differ because of the content that is being taught. Teachers of these different mathematics subjects may or may not possess the same characteristics used in this study. The findings of the teacher characteristics may be transferrable across classes. The characteristics of "they all cared for all of their students, believed all students could learn/succeed, and saw their work as a calling and believed they could make a difference in their students' lives" seemed to be characteristics that could be transferred across other mathematics classes. On the other hand, the characteristic of "valued the culture and language of students and their families" seemed more statistics-specific. The subject of statistics seemed to lend itself to this one particular characteristic of culturally relevant teaching. However, *how* these characteristics are shown in the content and context of the different classes would not necessarily transfer.

An important note about this study, and perhaps a novel piece that adds to the literature, is that there are critical topics in statistics that are unique to high school-level students. Pregnancy statistics and statistics about AIDS are two notable topics that are relevant to the secondary level. At the secondary level, sex education is part of the curriculum and students are thinking about issues related to sex. Teen pregnancy and AIDS are mentioned only because they can occur as a result of having sex. In addition, diseases that affect the African American community such as heart disease, high blood pressure, and strokes also are serious topics that are relevant to high school level students. Elementary and middle school students may not yet be mature enough or appreciate the lessons that come from discussions related to these topics.

Additionally, these teacher participants had to create and maintain genuine, caring relationships with their students to be able to use critical topics to teach statistical concepts. These teachers also had to build trust with their students to discuss sensitive topics, such as teen pregnancy and sexually transmitted diseases, which were also utilized in communicating statistical principles.

The researcher did not find any other studies that studied culturally relevant teaching in high school-level statistics classes. The researcher did, however, find another study that used culturally relevant teaching and statistics (Enyedy & Mukhopadhyay, 2007). The present study actually is a classroom-based observational study, not an intervention-based study. The researcher did not try to incorporate culturally relevant elements into statistics. Teacher participants were sought who used culturally relevant practices in their high school-level statistics classroom to try to illustrate what it looks like on the secondary level.

5.4 Implications of the Study

Studies to improve the academic performance of diverse students have been documented by researchers and educators for some years (Bonner, 2009; Gutstein, 2003; Irvine, 1990; Lattimore, 2005). In this section, the researcher presents the implications of the study that was conducted in three high schools with three different secondary-level mathematics teachers. The findings of this study provide evidence that refutes a myth about teachers who use culturally relevant practices. There is a myth that states only teachers of color can be culturally relevant teachers (Irvine, 2010; Irvine & Armento, 2001). This study had a diverse sample of teachers; yet, they were able to incorporate culturally relevant practices in their statistics classrooms.

While there is certainly a need for teachers to be recruited from a variety of backgrounds and ethnicities, an implication of this study is that any teacher can effectively implement culturally relevant practices. Such practices are not only for teachers who look like or mirror the population of students that they teach. To implement culturally relevant practices effectively, the study found that teachers should possess a caring disposition. If teachers truly care about all students, believe that all can succeed, believe that their work is a calling, and value the culture and language of their students and families, this study suggests that these dispositions should enable any teacher to use culturally relevant practices to successfully teach statistics.

Another implication of this study will be of interest to mathematics and statistics educators seeking strategies to address culturally relevant pedagogy. These educators may be able to use findings and ideas from this study when examining secondary or high school-level classes. The classroom depictions from this study may be used as a tool to illustrate what culturally relevant pedagogy may look like at a high school. Statistics educators who are focused on improving teaching practices at the secondary level may also be able to use this work to further their research. This study 1) presents topics (sports, teen pregnancy, etc.) that can be used at the secondary level to teach statistical concepts in a manner that better engages learners, 2) shows how mathematic educators who use culturally relevant practices are successful in teaching statistics by making the subject more relevant to the learner, and 3) reports culturally relevant and statistics education information that may be useful in supporting previous or initiating new research ideas. For example, how the high school teachers demonstrated characteristics of culturally relevant pedagogy adds to the culturally relevant research literature by

providing cases of statistics problems that may be used in research studies or teaching experiments as alternatives to routine textbook problems. Teacher education faculty members in any area may use this study as a tool of dialogue and to present more opportunities for pre-service teachers to learn about instructional strategies that address culturally diverse populations. For example, an instructor in a course might present each teacher's classroom description as case studies for discussion and ask teacher candidates to identify what teacher dispositions seem to be consistent across the three cases or what they notice that seems to demonstrate culturally relevant pedagogy. Such opportunities would provide teachers with an opportunity to reflect on and evaluate their own beliefs about cultural relevance. Teacher candidates might be asked to write about or discuss what they believe cultural relevance is and why it is important based on the case read. As a result, the candidates may become more aware of their assumptions and expectations for student of various cultural backgrounds.

A further implication valuable to mathematics educators who teach statistics is that the use of relevant data positively impacts the teaching of statistics. Using the research in reference to culturally relevant teaching and teaching statistics, mathematics educators who teach statistics should recognize that using relevant data is beneficial in teaching statistics because using relevant data is effective in relating statistical concepts to real-life situations (Mvududu & Kanyongo, 2011). Findings from this study suggest that the use of data that is relevant to students has numerous benefits and, therefore, should be used by mathematics educators who teach statistics.

5.5 Recommendations and Suggestions for Future Research

This study provided information on beliefs and practices of three teachers who incorporated culturally relevant pedagogy in their high school-level statistics classrooms.

These teachers use culturally relevant teaching and would likely not change how they teach African American students. It would be informative to investigate how well students of these teachers perform on state-mandated, end-of-course tests as compared to the students of teachers who use a more traditional approach in presenting the material. Using a statistical analysis of quantitative data would enable the comparison of test scores. Also, a longitudinal examination of how the students' attitudes towards mathematics and statistical classes in college were affected by being in a culturally relevant high school-level statistics class may be a beneficial study.

This study focused more on the community referents and interactions of the culturally relevant teachings in a high school-level statistics classroom. Future research should also include other aspects of culturally relevant teaching such as social justice cases. Future research could focus on social justice topics like hunger, welfare, public health, racial profiling, or other topics relevant to the students. Such studies could show how this social justice data might impact students.

As an extension of this study, future research should also use the students as the participants. Researchers should create instruments to measure how culturally relevant teaching in high school-level statistics classes affects students from the perspective of the students, instead of the teachers. Future studies should include a student data sheet to collect demographic and background information about students. Another instrument that should be created for future study would be a validated survey to see how students feel culturally relevant teaching in statistics is beneficial to them. This survey would also ask students to ascertain which particular attributes of culturally relevant teaching they *believe* help them learn statistics.

The researcher stated the following as hypotheses for this study: if African American students are presented with culturally relevant teaching (if it can be demonstrated in a statistics classroom), the students may be more motivated in the classroom. Also, if teachers use culturally relevant teaching, it may change the mindset of African American students and increase their self-efficacy. The motivation, mindset, self-efficacy, and objective performance data (e.g., test scores) of African American students were not measured in this study and would be fertile topics for future study.

Although there is a vast amount of research on culturally relevant teaching practices for ethnically diverse students (Gay, 2010; Gutstein et. al, 1997; Irvine, 2010; Ladson-Billings, 2009), there are limited research efforts on students' perceptions and interpretations of teachers who implement the approach (Leonard & Guha, 2002; Sampson & Garrison-Wade, 2011). It is important to investigate students' perceptions of high school mathematics teachers who practice culturally relevant teaching.

The teacher-student and student-student relationships that are cultivated by teachers who use culturally relevant teaching in high school-level statistics classrooms are vital to maintaining the elements of culturally relevant teaching. The uniqueness of this study comes as a result of the intersection of culturally relevant pedagogy, high school level, and statistics education. Culturally relevant teaching within a classroom-based setting exists at the secondary level and can potentially positively impact the engagement of African American students in the classroom today as it prepares them for tomorrow's successes.

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APPENDIX A – INVITATION LETTER TO SUPERINTENDENTS

Dear Superintendent _____,

My name is LaShaune Smith and I am a doctoral candidate at The University of South Carolina and will be enrolled in EDTE 899, *Doctoral Research and Dissertation Preparation*. For my dissertation research, I will be conducting a research study that investigates the effects of culturally relevant teaching on African American students enrolled in a statistics class. This study is targeted towards high school (grades 9 – 12) teachers and students in the Midlands and Santee-Lynches school regions, schools that serve populations of predominately African American students.

This study involves three phases. Phase One consisted of identification of schools and possible sites for research. A list of schools in the surrounding areas was obtained from the South Carolina State Department of Education's website, then a list of possible research sites was determined by obtaining the list of attendance for all schools by gender and race. The top ten schools with the highest percentage of African American student attendance in the regions were chosen.

Phase One of the study also consists of sending an approval letter to the district superintendents to obtain permission to conduct research at a chosen site. Once the superintendent grants permission for research to take place at a chosen school in the district, the principal of the school will be contacted. The principal will be notified that the researcher has written approval from the superintendent for participation in the study. And, the principal will be asked to identify teachers for participation in this study. I am seeking **mathematics teachers who teach statistics** and possess the following characteristics:

- The teacher believes all students can learn
- The teacher values the culture and language of children and their families
- The teacher cares about all children and
- The teacher sees their work as a calling; that means they believe that together with the children and their families, they can make a difference in children's lives and their communities.

I will ask the principals to recommend teachers considered to be successful in the communities and to give feedback to indicate what qualities make the teacher(s) successful.

During Phase Two, the researcher will make contact with the teachers from a compiled list of suggested teachers to conduct the research project. Phase Two consists of a data sheet and an interview with the teachers to collect demographic information and ideas about culturally relevant teaching in their classrooms.

In Phase Three, the researcher will conduct classroom observations. The focus of the observations will be to observe the participant teaching practices, instruction, curriculum, assessment, and learning environment to determine if they align with culturally relevant pedagogy.

About the study:

The data sheet and interviews pose no risk to your students or teachers. Although teachers and students will be asked to reveal demographic information, their anonymity and privacy will be protected. School, district, and participants' names will not be revealed in the formal write-up of the study.

Participation is totally voluntary. Teachers may choose not to answer any question(s) or refuse to participate in the study entirely. An information form and consent to participate form will be emailed to each teacher chosen to participate.

The data form will pose minimal level of effort from the school and teacher. The teacher will initially be contacted via email or phone. An email will be sent as a follow-up with an information letter, a participation consent form, and data sheet form, which will request demographics information. The teacher will be asked to mail back the consent form and electronically submit the data sheet. The data sheet can be completed from any location and at any time outside of school hours. Interviews will be conducted outside of class at a neutral location. Classroom observations will be conducted; these observations will be recorded by video or audio methods.

If you consider your teachers' participation vital for the success of this study, please submit a letter of approval to me within 5-7 days. In the letter, please include the name(s) and address(es) of the high schools you are allowing to participate in the study. This letter of approval serves as: 1) written confirmation that you would like for your teachers to participate in the study and 2) permission to inform the school principal(s) of the study. Upon your approval, a letter will be submitted to the principal of the high school(s) in your district. Teachers will also be notified of your approval.

If you have any questions about this study, please feel free to contact me at (803) 899-xxxx or at ********@yahoo.com or my faculty advisor, Dr. Jan Yow, at (803) 777-xxxx or ****@mailbox.sc.edu if you have study related questions or problems. If you have any questions about your rights as a research participant, you may contact the Office

of Research Compliance at the University of South Carolina at 803-777-7095. I look forward to your letter of approval.

Sincerely,

LaShaune N. Smith
Doctoral Candidate: Instruction and Teacher Education
The University of South Carolina
1xx Colony Drive
Camden, SC 29020

APPENDIX B – INVITATION LETTER TO PRINCIPALS

Dear Mr. or Ms._____,

My name is LaShaune Smith and I am a doctoral candidate at The University of South Carolina, and will be enrolled in EDTE 899, *Doctoral Research and Dissertation Preparation*. For my dissertation research, I will be conducting a research study that investigates the effects of culturally relevant teaching on African American students enrolled in a statistics class. This study is targeted towards high school (grades 9 – 12) teachers and students in the Midlands and Santee-Lynches school regions, schools that serve populations of predominately African American students.

This study involves three phases. Phase One consisted of identification of schools and possible sites for research. A list of schools in the surrounding areas was obtained from the South Carolina State Department of Education's website, and then a list of possible research sites was determined by obtaining the list of attendance for all schools by gender and race. The top sixteen schools with the highest percentage of African American student attendance in the regions were chosen.

Phase One of the study also consisted of sending an approval letter to the district superintendents to obtain permission to conduct research at a chosen site. Once the superintendent granted permission for research to take place at a chosen school in the district, the principal of the school will be contacted. The principal (you) is (are) formally being notified that I have written approval from the superintendent for participation in the study. And the principal (you) is (are) being asked to identify teachers for participation in this study. I am seeking **mathematics teachers who teach statistics** and possess the following characteristics:

- The teacher believes all students can learn
- The teacher values the culture and language of children and their families
- The teacher cares about all children and
- The teacher sees their work as a calling; that means they believe that together with the children and their families, they can make a difference in children's lives and their communities.

I am asking the principals (you) to recommend teachers considered to be successful in the communities and to give feedback to indicate what qualities make the teacher(s) successful.

During Phase Two, the researcher will make contact with the teachers from a compiled list of suggested teachers to conduct the research project. Phase Two also consists of an interview with the teachers to collect demographic information and ideas about culturally relevant teaching in their classrooms.

In Phase Three, the researcher will conduct classroom observations. The focus of the observations will be to observe the participant teaching practices, instruction, curriculum, assessment, and learning environment to determine if they align with culturally relevant pedagogy.

About the study:

The data sheet and interviews pose no risk to your teachers. Although teachers will be asked to reveal demographic information, their anonymity and privacy will be protected. School, district, and participants' names will not be revealed in the formal write up of the study.

Participation is totally voluntary. Teachers may choose not to answer any question(s) or refuse to participate in the study entirely. An information form and consent to participate form will be emailed to each teacher chosen to participate.

The data sheet will pose minimal level of effort from the school and teacher. The teacher will be contacted via email or phone, initially. An email will be sent as a follow-up with an information letter, a participation consent form, and data sheet, which includes demographics information. The teacher will be asked to mail back the consent form and electronically submit the data sheet. The data sheet can be completed from any location and at any time outside of school hours. Classroom observations will be conducted; these observations will be recorded by video or audio methods.

If you consider your teachers' participation vital for the success of this study, please submit a letter of recommendation to me within 5-7 days. In the letter, please include the name(s) and contact information of the high schools teachers you are suggesting as participants in the study. This letter of recommendation serves as: 1) written confirmation that you would like for your teachers to participate in the study and 2) permission to inform the teacher(s) of the study. Upon your recommendation, an information letter will be sent to the teachers as notification of your support.

If you have any questions about this study, please feel free to contact me at (803) 899-xxxx or at ********@yahoo.com or my faculty advisor, Dr. Jan Yow, at (803) 777-xxxx or ****@mailbox.sc.edu if you have study related questions or problems. If you have any questions about your rights as a research participant, you may contact the Office of Research Compliance at the University of South Carolina at 803-777-7095. I look forward to your letter of recommendation.

Sincerely,

LaShaune N. Smith
Doctoral Candidate: Instruction and Teacher Education
The University of South Carolina
1xx Colony Drive
Camden, SC 29020

APPENDIX C – ASSENT FORM FOR MATHEMATICS TEACHERS

Study Title: Culturally Relevant Teaching: A Case Study on Teaching Statistics in the High School Setting

Dear High School Mathematics Teacher,

My name is LaShaune Smith. I am a doctoral candidate in the Instruction and Teacher Education Department at the University of South Carolina. I am conducting a research study as part of the requirements of my degree in Secondary Education, and I would like to invite you to participate.

I am studying the effects of culturally relevant teaching on African American students enrolled in a statistics class. In this research study, I will observe African American students who are being taught statistics by a teacher who uses culturally relevant teaching practices. If you decide to participate, you will be asked to complete a data sheet about your demographic information. In addition, you will be asked questions about your teaching practices and beliefs about teaching African American students. The meeting will take place at a mutually agreed upon time and place and should last about 30 -45 minutes. The interview will be audio-taped so that I can accurately reflect on what is discussed. The recording will only be reviewed by members of the research team who will transcribe and analyze them. They will then be destroyed.

You may feel uncomfortable answering some of the questions. You do not have to answer any questions that you do not wish to. Although you probably will not benefit directly from participating in this study, we hope that others in the community and society in general will benefit by using this study as a resource for future studies. Others may also be able to use this study to initiate dialogue about culturally relevant teaching in classrooms and at professional development seminars.

Participation is confidential. Study information will be kept in a secure location at the University of South Carolina. The results of the study may be published or presented at professional meetings, but your identity will not be revealed.

Taking part in the study is your decision. You do not have to be in this study if you do not want to. You may also stop being in the study at any time or decide not to answer any question you are not comfortable answering.

We will be happy to answer any questions you have about the study. You may contact me at (803) 899-xxxx or ******@yahoo.com or my faculty advisor, Dr. Jan Yow, at (803) 777-xxxx or ****@mailbox.sc.edu if you have study-related questions or problems. If you have any questions about your rights as a research participant, you may contact the Office of Research Compliance at the University of South Carolina at 803-777-7095.

Thank you for your consideration. If you would like to participate, please sign the consent form and open the attached data sheet and begin completing the study materials. When you are done, please mail the consent form and email the data sheet with your answers. Please sign the attached form and return it to me.

With kind regards,
LaShaune N. Smith
1xx Colony Drive
Camden, SC 29020
********@yahoo.com

APPENDIX D – TEACHER DATA SHEET

Teacher Demographic Information Questions

Please complete the requested information. This information will be kept confidential.

1. What is your gender? Female □ Male □

2. What is your age? *Circle one category below.*

22 – 26 years old	27 – 30 years old	31 – 35 years old	36 – 40 years old	Older than 40

3. What is your race/ethnicity? _____

4. What is your highest degree earned? *Circle one category below.*

Bachelor's Degree	Master's Degree	Master's +30	Doctoral degree	Other _____

5. How many years have you taught?

0 (first year) – 3 years	4 – 7 years	8 – 10 years	11 – 15 years	16 – 20 years	More than 20 years

6. How many years have you taught at your present school?

0 (first year) – 3 years	4 – 7 years	8 – 10 years	11 – 15 years	16 – 20 years	More than 20 years

7. What is the name and type of high school you attended as a student?

_____

8. What is the name and type of college(s) you attended?

_____

9. What grade(s) do you presently teach? 9^{th} □ 10^{th} □ 11^{th} □
12^{th} □ All grades in HS □

10. What type of community were you raised in (e.g., I was raised in the country or I was raised in the city. I was raised in a small tight-knit community. I was raised in a large city. I was raised in a predominantly White/African American community.)

_____

11. What do you do to gain new ideas and insight into your teaching of statistics?

_____

12. What kinds of things have you done in your statistics classroom that has facilitated the academic success of African American students?

_____

*** Questions for data sheet were inspired by research from Kelly-Jackson (2008), Ladson-Billings (2009), and Sanders (2001).**

APPENDIX E – TEACHER INTERVIEW

Teacher Interview Questions

The purpose of this interview is to gather information on the practices that teachers use to increase academic performance of all students. Your answers will be confidential and reported as a group.

Directions: Please answer each question honestly and, when prompted, please explain your answers.

Mathematics Teaching

1. One of the reasons you were asked to participate is because you are regarded as a teacher who is committed to helping all students achieve. How do you show students and parents that you are deeply committed to helping all students achieve?

2. Do you engage in dialogue with students about values, the importance of learning, and the consequences of not getting a quality education? Why or why not?

3. What are you expectations of your African American students compared to your other students?

4. A. How did you choose math teaching as a profession? (Who were the particular people or what experiences influenced you to go into mathematics education?)
   B. Where was **statistics** on your priority list of classes to teach? Why?

5. Do you see yourself as an artist and teaching as an art? Explain please.

6. Some teachers see teaching as a way of giving back to the community. How do you use teaching as a way of giving back to the community? How do you encourage your students to follow this sentiment?

7. Do you help your students make connections between their community, national, and global identities by guiding them in the learning process? Can you give an example of how you do so?

8. What community referents (social, economic, religious, historical, or political) do you use to make connections to your students in teaching high school statistics?

9. How do you define and determine what is relevant in (statistics) teaching practices?

10. How do you connect new knowledge of statistics to home, community, and global settings?

11. Do you believe that all students can succeed and achieve? Why or why not?

Culture and Culturally Relevant Teaching

12. Do your students' background(s) influence the way you teach them? How?

13. Do you believe that culture has a strong impact on children's school success? Explain your answer.

14. Does your culture influence the way your students respond to you? Explain.

15. Do you think that understanding the culture of students is important for improving students' academic performance in your statistics class? Explain.

16. In what ways do you incorporate the students' culture into your statistics classroom?

17. What do you know about culturally relevant teaching? How do you define culturally relevant teaching?

18. How do your students benefit from culturally relevant teaching in your **statistics** class?

19. What do you perceive to be the challenges of culturally relevant teaching in a statistics classroom?

20. Do you have any additional comments or feedback?

*** Interview questions were inspired by research from Kelly-Jackson (2008), Ladson-Billings (2009), and Sanders (2001).**

APPENDIX F – POST-INTERVIEW REFLECTION FORM

Interview Summary and Reflection Form

Person Interviewed: _____ Date of Interview: _____

Interview Time: _____ Today's date: _____

Location of Interview: _____

1. What were the main issues or themes that struck you during your interview?

2. What was the most difficult aspect of the interview process?

3. How do you think the interview context (location/situation) enabled or constrained the interview process?

4. How did you do in building rapport with your participant?

5. Things that you learned about yourself as you conducted the interview:

6. Things you need to continue to work on for the next interview:

APPENDIX G – OBSERVATION ASSESSMENT AND REFLECTION FORM

Observation Assessment and Reflection Form

Observer: **LaShaune N. Smith** Today's Date: _____

Date and Time of Observation: _____

Observation Location: _____

Pre-Observation Questions

1. What do you (think you) know about this location (or locations like it) from previous experiences, word of mouth, etc?

2. Based on what you know, what do you expect to see upon entering the setting?

Post-Observation Questions

3. Identify the main information that you obtained (or failed to obtain) regarding the either a) the setting, b) the actors in the setting, or c) the action/activity in the setting [circle one].

4. Based on what you saw, list one **OBSERVATION-BASED** research question that could be asked concerning the place you observed?

5. What were the main issues or themes that struck you as salient, interesting, illuminating, or important in your observation at this setting? Why?

6. Things that I learned about myself as I attempted to described the social situation I observed:

7. Things I need to continue to work on for my next observation: